Crusader®

OWNER'S OPERATION

and

MAINTENANCE MANUAL

A Division of PLEASURECRAFT ENGINE GROUP

PLEASURECRAFT® ENGINE GROUP

PCM® Crusader®

Welcome to the growing family of Crusader Marine Engines owners. We are delighted you have chosen Crusader power for your boat and wish you many years of enjoyment.

READ THIS MANUAL THOROUGHLY

Before starting your engine(s), READ THIS MANUAL CAREFULLY AND COMPLETELY. If you do not understand any portion of the manual, contact your Dealer for clarification or assistance. Ask your Dealer for a demonstration of actual starting and operating procedures.

The descriptions and specifications contained in this manual were in effect at the time of printing. Crusader Marine Engines' policy of continued improvement reserves the right to change specifications or design without notice and without obligation.

This manual will cover the following Crusader engines:

Year	Model
2004	**5.0L MPI**
2004	**5.7L MPI**
2004	**6.0L MPI**
2004	**8.1L MPI**
2004	**8.1L MPI (HO)**

Part Number - L510001-04 Printed 06/04

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SAFETY INFORMATION

"Safety Warnings" and additional information or instructions are used to alert the installer/operator of possible safety hazards in performing certain service or maintenance procedures incorrectly or carelessly. DANGERS and WARNINGS are accompanied by the international HAZARD symbol: ⚠

These "Safety Warnings" alone cannot eliminate the hazards that they signal. Strict compliance with these warning instructions while performing service and maintenance procedures, plus "common sense" operation, are major accident prevention measures.

REPLACEMENT PARTS

⚠ DANGER

Electrical, ignition and fuel system components are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the possibility of fire or explosion hazard.

Use of replacement parts (i.e. automotive, after-market, etc.) in the electrical, ignition and fuel systems, which are not U.S. Coast Guard approved, could cause a fire or explosion hazard and should be avoided.

Always request that genuine Crusader Marine Engines replacement parts be used in any repairs or maintenance being performed on your engine(s).

SAFETY WARNINGS

⚠ DANGER

Signals serious damage, failure or breakdown of equipment; severe injury or high probability of death to the user if proper precautions are not taken. This signal word is applied in extreme situations

⚠ WARNING

Indicates a potential hazard which could result in personal injury.

⚠ CAUTION

Indicates a hazard which could result in damage to equipment.

IMPORTANT: or ***IMPORTANT:*** Used to provide information to perform a procedure more easily.

WARRANTY NOTICE: Indicates a possible warranty exclusion.

OWNER'S SERVICE AND WARRANTY INFORMATION

CRUSADER MARINE ENGINES' COMMITMENT TO YOU

Crusader Marine Engines is committed to assuring your satisfaction with your new Crusader engine. Your Dealer also wants you to be completely satisfied, and invites you to return for all your servicing needs, both during and after the warranty period.

OWNER WARRANTY REGISTRATION

It is important that your selling dealer fill out the "Warranty Registration Card" completely and mail it to the factory immediately upon the purchase of the new product. It identifies the name and address of the original purchaser, product model(s) and serial number(s), and the selling dealer's name and address. The dealer is also certifying that you are the original purchaser of the product.

Upon receipt of the "Warranty Registration Card" at the factory, you will be issued an "Owner Warranty Registration Card." The "Owner Registration Card" is your only valid registration identification, and must be presented to the servicing dealer, should warranty service be required.

If your "Owner Registration Card" is not received within 30 days from the date of purchase, please contact your boat dealer or engine seller. The product warranty is not effective until the Product is registered at the factory.

Mail registration information to:

Crusader Marine Engines
P.O. Box 369
Little Mountain, SC 29075

NOTE: OWNERS WARRANTY REGISTRATION CARD IS LOCATED AT THE BACK OF THIS MANUAL.

NOTICE: Registration lists must be maintained by the factory and dealer on marine products sold in the United States and some foreign countries, should notification under **FEDERAL BOAT SAFETY ACT** be required. It is our desire to have all products registered at the factory, should it ever be necessary to contact you. Make sure your Dealer/Distributor fills out the registration card immediately and sends the card to the factory.

SERVICE and WARRANTY - 1

ENGINE OPERATION AND CARE

Considering the investment that you have made in your new Crusader engine(s), we know you will want to operate and maintain it properly. We urge you to follow the maintenance instructions contained in your engine's "Operation and Maintenance Manual."

If you have any questions on how to keep your engine in good working condition, see your selling dealer, the place where many owners choose to have their maintenance work done. Your dealer can be relied on to use proper parts and practices.

MAINTENANCE RECORDS

It is recommended that receipts covering the performance of regular maintenance be retained. Damage to your engine, caused by lack of maintenance, is not covered under your warranty. Receipts can be very important if a question arises as to whether a malfunction is caused by lack of maintenance or a defect in material or workmanship. An "Engine Maintenance Log" is provided in the MAINTENANCE SCHEDULE section of the OPERATION AND MAINTENANCE MANUAL for your convenience in recording the service performed.

LOCAL REPAIR SERVICE

To obtain service or make a claim under your warranty, contact your selling dealer. They have trained technicians, knowledge and special tools and equipment to properly service your engine, if the need arises. They know you and your boat the best.

SERVICE AWAY FROM HOME

If you are away from home and your local dealer, and the need for service arises, contact the Crusader Captain's Club™ Concierge using your exclusive Captain's Club toll-free number. The Club Concierge is there to support your local dealer or locate the closest Crusader authorized technician. She can personally expedite parts orders so that in most cases, shipment is made within 24 hours, delivered on time to the location you specify.

REPLACEMENT PART INQUIRIES

All inquiries concerning replacement parts should be directed to your local authorized dealer. The dealer has the necessary information to order parts for you if they are not in stock. Only authorized distributors can purchase parts from the factory. Crusader Marine Engines does not sell to unauthorized dealers or retail customers. When checking on parts, the dealer will require the engine model and serial number to order the correct parts.

REPLACEMENT SERVICE PARTS

WARNING

Electrical, ignition and fuel system components on Crusader engines are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the risks of fire or explosion. Use of replacement electrical, ignition or fuel system components, which do not comply with these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all the components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

APPLICABLE LIMITED WARRANTY

Following is the limited warranty applicable to Crusader Marine Engines sold and used in the United States and Canada.

Distributors and Dealers are not agents of Crusader. Crusader does not authorize any person to create any other obligation or liability in connection with this product.

CRUSADER, INC. INBOARD MARINE ENGINES
ONE YEAR LIMITED WARRANTY
(For Engines Sold and Used in the United States and Canada Only)

1. Crusader, Inc. (hereinafter referred to as “Crusader”) warrants each of its new inboard marine engines and accessories attached thereto (“Products”), to be free from defects in material and workmanship for a period of one (1) year, except to the extent limited herein. This Limited Warranty commences on the day of the first retail sale and/or the first date used, and extends to the original and subsequent retail sales; however, in no event shall the duration of the Limited Warranty exceed one (1) year, as measured from the original retail sale date.
2. Under this Limited Warranty, Crusader’s obligation is limited to repairing or replacing those parts of Products that have become defective within the applicable warranty period, because of defective materials or workmanship. Crusader will arrange for the correction of all defects under this Limited Warranty to be made free of charge at the selling dealership or an authorized Crusader service center. Crusader, in its discretion, may provide for the repair or replacement of any defective part at Crusader’s facility. Crusader will make payment for labor to replace such parts as provided in the, then, current flat rate labor manual or Warranty Procedures Manual.
3. This Limited Warranty does not apply to Product defects caused by normal wear and tear to Products, and/or damage to Products arising out of negligence or lack of proper care, improper installation or service, operation with fuels, oils or lubricants which are not suitable for use with Products, alterations or removal of parts, water entering an engine through the exhaust system or carburetor, installation of accessories or parts not manufactured or sold by Crusader, or Products rendered defective by accident.
4. If a part should become defective within the applicable warranty period, advance authorization by Crusader is necessary before the part is replaced or a defect is corrected by a service representative; otherwise Crusader will not be liable for the expense of the replacement or correction.
5. Replacement parts and accessories supplied by Crusader, and installed on a Product during the period when the Product is covered under the provisions of this Limited Warranty, are warranted for the unexpired portion of the existing warranty period, or ninety (90) days from the date of installation of such new parts or accessories, whichever is longer.
6. Reasonable access to the Product must be provided for warranty service. This Limited Warranty does not cover: (1) telephone or telegram charges, towing charges, storage, launch and haul out charges, loss or damage to personal property, loss of revenue, loss of time, travel, lodging, inconveniences or other CONSEQUENTIAL DAMAGES, or (2) removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the Product.

7. **NO OTHER WARRANTY GIVEN**

   THE OBLIGATIONS SET FORTH IN THE PRECEDING PARAGRAPHS ARE CRUSADER'S SOLE OBLIGATIONS AND OWNER/USER'S EXCLUSIVE REMEDY. CRUSADER MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED (except to the extent provided in the immediately following paragraph), AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

   However, to the extent that any warranty may be implied by law, the term of such implied warranty shall be limited to a period of time corresponding to the period of express warranty applicable to the particular Product, and its use by the owner/user, as set forth herein, commencing on the date of the first retail sale of the Product to the first registered owner or registered user. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

   This is sole warranty provided respecting Crusader's Products, and no other party may make a warranty to owner/user.

   CRUSADER SHALL NOT BE LIABLE FOR ANY LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR DIRECT OR INDIRECT, INCIDENTAL (except as specifically provided herein) OR CONSEQUENTIAL DAMAGES. Some state do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

   Any owner/user hereby waives for himself/herself/itself and his/her/its successors and assigns (a) any and all claims for punitive damages, and (b) all claims of negligence or strict liability or both. In no event will Crusader's liability exceed the purchase price of the Products which is actually paid to Crusader.

8. To make a claim under this Limited Warranty, contact the selling dealer from which your Crusader powered boat was originally purchased or the nearest authorized Crusader servicing dealer. It is recommended that your warranty service be performed by the dealer which sold the Product to you because of that dealer's personal interest in you as a customer. Your Crusader powered Product must be delivered to the servicing dealer within the applicable warranty period. Proof of purchase may be required by the Crusader dealer to substantiate any warranty claim. Use your Crusader Owner Warranty Registration Card to establish proof of purchase.

9. ITEMS NOT COVERED UNDER LIMITED WARRANTY

This Limited Warranty is limited to defects in material and workmanship. To avoid misunderstandings regarding warranty coverage, the following describes some, but not all, of the more common types of service that are not covered by this Limited Warranty.

- Normal service requirements arising during the warranty period, such as fuel system or ignition adjustments, tune-ups, filter, adjusting controls or lubrications.
- Damage caused by neglect, lack of maintenance, abnormal operation accident or improper installation or service.
- Normal wear of the piston rings, cylinders, water pump and other engine parts.
- Haul out, launching, towing charges, dockage or storage fees, removal and/or replacement of boat partitions or material, because of boat design, for necessary access to the product.
- All related transportation charges and/or travel time.
- The cost of shipping replacement parts by air freight or other premium freight methods.
- Additional service work requested by the customer or performed by the dealer other than that necessary to satisfy the warranty obligation.
- Labor performed by other than an authorized dealer may be covered only under the following circumstances: when performed on an emergency basis (providing there are no authorized dealers in the area who can perform the work required, and prior factory approval has been given to have the work performed at this facility).
- Damage from participating in, or preparing for, racing or other competitive activity.
- Water entering the engine cylinders or oiling system through the intake manifold system, exhaust system, submersion, or in any manner if not caused by a Crusader manufacturing defect.
- Water in starters.
- Improper winterizing resulting in freezing and breaking of the engine block, cylinder heads, exhaust manifolds, heat exchanger or other damage.
- Repairs made necessary by normal wear, rust, electrolysis or corrosion, or by the use of the parts or accessories which are either incompatible with the Crusader product or adversely affect its operation, performance or durability.
- Valve or valve seat grinding required because of wear.
- Failure or damage due to lack of cooling water caused by starting the Product out of the water or by foreign material blocking the water inlets.
- Cleaning of the engine fuel system due to water or dirt contamination of the boat fuel system.
- Use of fuel and lubricants which are not suitable for use with or on the Product. Refer to the Operation and Maintenance Manual.
- Damage to the engine and/or transmission caused by striking a submerged object. (This is considered a marine hazard).

10. This Limited Warranty shall be governed by, and construed and interpreted in accordance with, the laws of the State of Ohio, without application of its conflicts of laws principles, except only to the extent replaced or precluded by other law of mandatory application.

11. SPECIAL STATE LEGAL REQUIREMENTS

This Warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

The Crusader California Model Years 2003-2008 Emissions Warranty and California Emission Control Warranty Statement is a separate document included in this Manual. Any questions concerning the Emissions Warranty can be obtained by calling 1-586-977-0100.

THINGS YOU SHOULD KNOW ABOUT THE WARRANTY

Warranty Repair Component Exchanges

In the interest of customer satisfaction, Crusader Marine Engines may offer an exchange service on some engine components. This service is intended to reduce the amount of time that your boat is not available for use, due to repairs. Components used for the exchange service may be new, remanufactured, reconditioned or repaired, depending upon the component involved. All exchange components used meet Crusader standards and are warranted the same as new components.

Production Changes

Crusader Marine Engines and its Distributors reserve the right to make changes in the engines built and/or sold by it at any time without incurring any obligation to make the same or similar changes on engines previously built and/or sold.

Proof of Date of Purchase

Crusader will accept the return of a properly filled out “Warranty Registration Card”, supplied with each engine, as proof of purchase. Failure of purchaser to return such card will require the owner to provide a copy of the original “Bill of Sale” (sales contract) for the Product to be serviced. Warranty claims will not be accepted until adequate “Proof of Purchase” is presented by the purchaser, and the date of purchase is substantiated.

Access to Product

Reasonable access must be provided to the Product for warranty service. The warranty does not cover the removal and/or replacement of boat partitions and/or other components which must be removed for necessary access to the Product.

CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board and Crusader, Inc. (hereinafter “Crusader”) are pleased to explain the emission control system warranty on your Model Years 2003-2008 inboard engine. In California, new inboard engines must be designed, built and equipped to meet the State’s stringent anti-smog standards. Crusader must warrant the emission control system on your inboard engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your inboard engine.

Your emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Crusader will repair your inboard engine at no cost to you, including diagnosis, parts and labor.

MANUFACTURER’S WARRANTY COVERAGE:

Select emission control parts from Model Years 2003-2008 inboard engines are warranted for 2 years.

OWNER’S WARRANTY RESPONSIBILITIES:

- As the inboard engine owner, you are responsible for the performance of the required maintenance listed in your owner’s manual. Crusader recommends that you retain all receipts covering maintenance on your inboard engine, but Crusader cannot deny warranty coverage solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance.

- As the inboard engine owner, you should however be aware that Crusader may deny you warranty coverage if your inboard engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

- You are responsible for presenting your inboard engine to a Crusader distribution center as soon as a problem exists. The warranty repairs will be completed in a reasonable amount of time, not to exceed thirty (30) days.

If you have any questions regarding your warranty rights and responsibilities, you should contact Crusader at 1-586-977-0100.

CRUSADER, INC. MODEL YEARS 2003-2008 GENERAL EMISSIONS WARRANTY COVERAGE

1. Crusader, Inc. (hereinafter referred to as “Crusader”) warrants to the first owner purchasing at retail, and all subsequent owners, of every Crusader Model Years 2003-2008 inboard engine that the emissions control devices on Crusader inboard marine engines are free from defects in materials and workmanship when manufactured and will remain so for a period of two (2) years from the date of delivery to the first owner purchasing the engine at retail or from the date the engine is first placed into service for demonstration or any other purpose prior to sale to the first owner purchasing the engine at retail.

2. Pursuant to the California Code of Regulations Title 13, Chapter 9, Article 4.7§ 2445.1, Crusader warrants that each Crusader engine is designed, built and equipped to conform with all applicable regulations adopted by the California Air Resources Board pursuant to its authority in Chapters 1 and 2, Part 5, Division 26 of the Health and Safety Code, and is free from defects in materials and workmanship that cause the failure of a warranted part to be identical in all material respects to that part as described in Crusader’s application for certification.

3. Any part covered under this Warranty that is not scheduled for replacement as required maintenance, in the written instructions to be found within the Crusader Owners/Operators Manual, is warranted for the period of two (2) years. If the part fails during the period of warranty coverage, Crusader will repair or replace the defective part at any Crusader warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the two (2) year period.

4. Any part covered under this Warranty that is scheduled only for regular inspection in the written instructions to be found within the Crusader Owners/Operators Manual, is warranted for the period of two (2) years. If the part fails during the period of warranty coverage, Crusader will repair or replace the defective part at any Crusader warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the two (2) year period.

5. Any part covered under this Warranty that is scheduled for replacement as required maintenance in the written instructions to be found within the Crusader Owners/Operators Manual will be warranted for the period of time before the first scheduled replacement date for that part. If the part fails before the first scheduled replacement, Crusader will repair or replace the defective part at any Crusader warranty station. The repair or replacement will be performed at no charge to the owner. Any such part repaired or replaced under this Warranty will be warranted for the remainder of the period prior to the first scheduled replacement date for the part.

6. Replacement of any part under this Warranty with a Crusader supplied part, will not shorten nor extend the warranty period(s) stated in paragraphs one (1) thru five (5) above.

7. The engine owner will not be charged for diagnostic labor that is directly associated with diagnosis of a defective, emission-related warranted part, provided that such diagnostic work is performed at a Crusader warranty station.

8. To insure prompt repair under this Warranty, Crusader will maintain a supply of warranted parts sufficient to meet the expected demand for such parts. Any replacement part may be used in the performance of any warranty maintenance or repairs and will be provided by Crusader without charge to the owner.

9. Parts covered under this warranty are: spark plugs, spark advance/retard system, ignition coil and/or control module, ignition wires, PCV valve, oil filler cap, intake valve(s), intake manifold, exhaust manifold, exhaust valve(s) hoses, clamps, fittings, tubing, sealing gaskets or devices, mounting hardware, pulleys, belts and idlers, temperature check, and valves and switches and electronic controls.

10. Exclusions: The repair or replacement of any warranted part otherwise eligible for coverage under this Warranty may be excluded from such warranty coverage if Crusader demonstrates that the engine and/or part has been abused, neglected, or improperly maintained, and that such abuse, neglect, or improper maintenance was the direct cause of the need for repair or replacement of the part.

11. Crusader original equipment parts are “identical in all material respects to that part as described in the engine manufacturer’s application for certification”. The use of any replacement parts not supplied by Crusader may not meet this requirement and will be grounds for disallowing a claim made under this Warranty. Crusader will not be liable under this Warranty to provide warranty coverage for product failures caused by parts other than Crusader original equipment parts.

12. If you have any questions regarding your warranty rights and responsibilities, or the location of Crusader warranty stations, you should contact Crusader at 1-586-977-0100.

MARINE TRANSMISSIONS

Crusader Marine Engines are equipped with transmissions designed, built and warranted by other manufacturers. Although much of the transmission warranty is handled through Crusader Marine Engines, there may be issues for which, you, the owner, may want to contact the transmission manufacturer directly. The transmission suppliers are listed below for your reference. A tag is attached to each transmission showing the manufacturer, transmission model and serial number. Have this tag information available whenever contacting the manufacturer.

Velvet Drive Transmissions
1208 Old Norris Road
P.O. Box 238
Liberty, SC 29657
Phone: (864) 843-9234
www.velvetdrive.com

ZF Marine - Hurth Marine Transmissions
3131 SW 42nd Street
Ft. Lauderdale, FL 33312
Phone: (954) 581-4040

CAPTAIN'S CHOICE SERIES EXTENDED BUYER PROTECTION PLAN

United States and Canada ONLY

Captain's Choice Series Engines include a buyer protection plan which provides coverage against unexpected mechanical and electrical breakdowns for an additional two (2) years after the expiration of the Crusader Limited Warranty. See the program brochure or your dealer for details.

SERVICE and WARRANTY - 1

RESOLVING A SERVICE PROBLEM

Your satisfaction and faith in the product are of major importance to your dealer and to Crusader Marine Engines. Any problems with service, warranty or operation of your Crusader powered boat will be resolved by your dealer. He should be your primary source of information on your boat. Should there be a misunderstanding, or if your problem has not been resolved to your satisfaction, please follow these steps:

Step One - Discuss Your Problem With One Of The Dealership Management Personnel

Misunderstanding or complaints can be resolved quickly by the dealer. Discuss your problem with the dealership's service manager. If you are still unable to obtain satisfaction, contact the dealership's owner.

Step Two - If Your Complaint Has Not Been Resolved To Your Satisfaction, Contact The Crusader Captain's Club™ Concierge

When contacting the Club Concierge:

- Call the confidential toll free number you received with your Captain's Club™ membership between 8:00 a.m. and 5:00 p.m. EST, Monday through Friday.
- Have your Captain's Club™ membership card availabe, so you can provide the Club Concierge with your PIN.
- Details of your problem or complaint

Your Crusader engine warranty, Captain's Choice Series Extended Buyer Protection Plan, and Captain's Club™ membership are activated when your dealer sends in the warranty registration cards for your engine(s). You will recieve your Crusader Captain's Club™ membership package after Crusader receives the warranty registration card(s). If you have not received your Club membership, follow up with your dealer to ensure that your engine(s) warranty registration has been filed.

DEALERS RESPONSIBILITIES

In general, the dealer's responsibilities to you, the customer, include pre-delivery inspection and preparation such as:

- Make sure that the boat is properly equipped
- Prior to delivery, make certain that the Crusader Engine is in proper operating condition
- Make all necessary adjustments for maximum efficiency
- Familiarize you, the owner, with the on-board equipment
- Explain and demonstrate the operation of the engine, and also the boat
- Explain warranty policies and deliver all operating manuals for the engine and the boat
- Complete the owner's warranty registration card and return it to the factory

SERVICE and WARRANTY - 1

TRANSFERABLE WARRANTY

The product limited warranty is transferable to a subsequent purchaser, but only for the remainder of the unused portion of the limited warranty. This will not apply to the products used for commercial applications.

DIRECT SALE BY OWNER

The second owner can be registered as the new owner, and may retain the unused portion of the limited warranty. The forms and instructions necessary to transfer the unused portion of the Crusader One year Limited Warranty are provided in Forms, section 18 of this manual.

The Captain's Choice Series Extended Buyer Protection Plan is administered by First Protection Corporation and the remainder of that warranty can be transferred by following the instructions provided with your Buyer Protection Policy.

Upon receipt of the transfer application a new "Owner Warranty Registration Card" will be issued with the new owner's name and address. Registration records will be changed on the factory computer registration file.

BOATING RESPONSIBILITIES - 2

CARBON MONOXIDE HAZARD

DANGER

Carbon Monoxide (CO) is a colorless, odorless and tasteless gas. You cannot see it, smell it or taste it. Prolonged exposure to carbon monoxide can lead to unconsciousness, brain damage or death!

Carbon monoxide is produced when anything that contains carbon, such as gasoline, natural gas, oil, propane, coal or wood is burned. Carbon monoxide is commonly found in the exhaust of internal combustion engines (boat power plants, generators, etc.). In addition, open flame devices like cooking ranges, heaters and charcoal grills also produce carbon monoxide.

Carbon monoxide accumulation, in and around boats is affected by vessel geometry; overall vessel design; closeness to other structures; wind direction; boat speed; and many other variables. In no way can this section cover all of the possible variables. Do not rely on this section as the exclusive listing of measures to prevent the accumulation of carbon monoxide.

Consult your boat operators manual for detailed information on the inspection and/or maintenance of the exhaust system for your particular application. If an inspection reveals possible leaks, DO NOT operate your engine(s) until it can be serviced by a qualified technician.

Proper and adequate air circulation, around and throughout the boat, is absolutely necessary to aid in the prevention of carbon monoxide build-up. If you have any questions or concerns regarding the operation of your boat and carbon monoxide hazards, DO NOT operate your engines until you have contacted your boat manufacturer.

To find out more about making boating safer, including how you can prevent carbon monoxide poisoning on recreational boats, contact:

National Marine Manufacturers Association
200 East Randolph Drive
Suite 5100
Chicago, IL 60601-6528
www.nmma.org
312-946-6200

United States Coast Guard
Office of Boating Safety
CG Headquarters G-OPB-3
2100 Second Street SW
Washington, DC 20593
www.uscgboating.org
202-267-0984

American Boat & Yacht Council, Inc.
3069 Solomon's Island Road
Edgewater, MD 21037-1416
www.abyc.com
410-956-1050

SAFE BOATING SUGGESTIONS

The nation's waterways are becoming increasingly crowded and, in order to enjoy them safely, the operator should acquaint himself/herself with safe boating practices. Boating safely and seamanship courses are offered by the following national and state organizations:

- Power Squadrons
- Coast Guard Auxiliary
- Red Cross
- State, provincial or local agencies in charge of water safety enforcement

Crusader Marine Engines highly recommends that all power boat operators attend one of these courses. To help locate a course being offered near you, contact Boat U.S. Foundation's toll-free national boating safety hotline, 1-800-336-BOAT, and in Virginia, 1-800-245-BOAT.

WATER WISDOM

The following are suggestions for safe operation of your boat to ensure the safety of yourself and your passengers:

- Know your boat's loading and operating limitations. DO NOT OVERLOAD!
- Make periodic checks of safety equipment onboard.
- Do not consume alcoholic beverages or take illegal drugs when operating a boat. Some state laws apply to boats as well as motor vehicles.
- File a "float plan." Let someone know your destination and your expected time of return.
- Monitor the weather. Know the signs of weather change and avoid severe weather and rough seas whenever possible.
- Follow the "Rules of the Road" when boating. Always be on the alert and watch out for "the other guy."
- Plan and chart your course. Be aware of, and avoid, hazardous areas.
- Be sure your boat is equipped with the required safety equipment. Check with the Coast Guard and local government agencies as to the regulations and restrictions in your area. Contact your local Coast Guard Auxiliary and take advantage of their seasonal boat inspections.

The following is a list of suggested safety equipment and spare parts which may be useful in case of an emergency:

- Approved personal flotation devices (life jackets); one for each person on board.
- Approved throwable personal flotation device for man-overboard protection.
- Approved fire extinguishers
- Signal devices: flares, spotlight, signal flag and horn or whistle
- Crusader Marine Engines' "Onboard Kit," plus spare fuses, bulbs, batteries, etc. Tools necessary for minor repairs
- Spare propeller
- Anchor and anchor line
- First aid kit and first aid book
- Ship-to-shore radio, compass and chart of the area in which you are traveling
- Manual bilge pump and spare drain plugs
- Waterproof storage containers

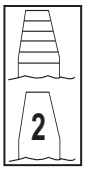
OPERATION AND MAINTENANCE

It is the owner's/operator's responsibility to perform all safety checks before operating his/her boat. All lubrication and maintenance schedules must be adhered to assure optimum performance and dependability from your Crusader engine. When service and maintenance are required, return to your authorized Crusader Marine Engines Dealer.

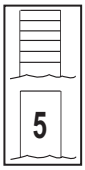
BOATING RESPONSIBILITIES - 2

RULES OF THE ROAD
Channel Buoy Guide

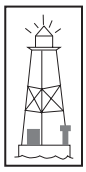
The color of the paint is the only characteristic which has the same meaning on all buoys. Red buoys always indicate the starboard side of the channel from seaward. (Red Right Returning)



1. **Nun Buoy:** This buoy indicates the starboard side of the channel when returning from sea. It is conical shape, the color red and indicates even numbers. A nun buoy with red and green horizontal bands (top band red), and not numbered, indicates an obstruction. The principal channel is to the left of the buoy when returning from sea.

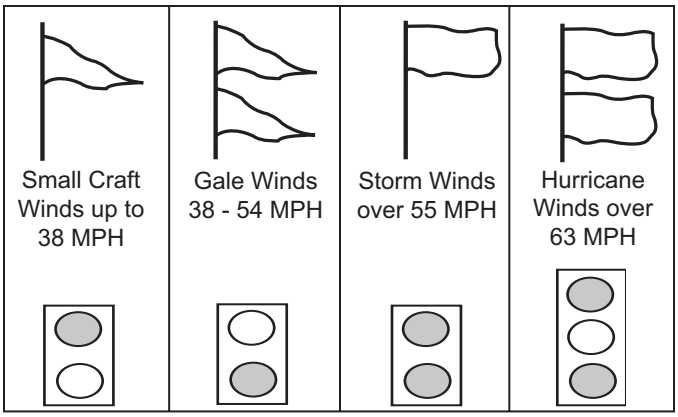


2. **Can Buoy:** This buoy indicates the port side of the channel when returning from sea. It is cylindrical shape, the color green and indicates odd numbers. A can buoy with green and red horizontal bands (top band green), and not numbered, indicates an obstruction. The principal channel is to the right of the buoy when returning from sea.



3. **Lighted Buoy (RED):** This buoy has a flashing red light. It indicates the starboard side of the channel when returning from sea.

4. **Lighted Buoy (GREEN):** This buoy has a quick flashing green light. It indicates the port side of the channel when returning from sea. The quick flashing light indicates special caution required.



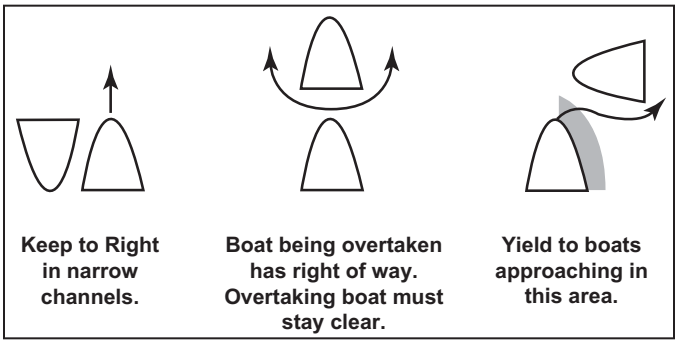
Storm Warning Signals - Pennants (by day)
Lights (by night)

Boat Capacity

- Load only to manufacturer's specifications
- Distribute load evenly; keep it low
- Passengers should only ride on the parts of the boat that are designed for that purpose
- If water is rough, carry fewer passengers

Observe the Rules of the Road

PORT (Left) - Leaving the harbor with green buoys to your right.
STARBOARD (Right) - Entering the harbor with red buoys to your right.


Keep to Right in narrow channels.
Boat being overtaken has right of way. Overtaking boat must stay clear.
Yield to boats approaching in this area.

Know Your Horn Signals

1 Short Blast = Passing you on my port side
2 Short Blasts = Passing you on my starboard side
3 Short Blasts = I am going astern
5 Short Blasts = Danger
Always refer to the latest U.S. Coast Guard Navigation Rules CG-169.

Keep An Alert Lookout For:

Bad weather, Swimmers, Other boats, Water skiers, Fisherman, Divers and/or any other obstructions

Keep Your Wake Under Control, particularly upon entering or leaving harbor areas. You are responsible for wake damage to other vessels and/or property.

Do Not Fool With Fuel

1/2 pint of gasoline = 15 sticks of dynamite

1. During fueling, moor boat properly; remove all passengers.
2. Keep all doors, hatches and ports closed.
3. Shut down all electronic gear; extinguish galley fires, pilot lights and smoking materials.
4. Do not overload tanks.
5. Keep filling nozzles in contact with the fill pipe to prevent sparks.
6. Secure the fill cap tightly; wipe away any spillage.
7. Ventilate all components for a minimum of five minutes before starting engines.
8. Keep fuel lines and bilges clean.

ENGINE IDENTIFICATION

When ordering service parts or obtaining information, always give the engine model and the serial number. This information can be found on the following decal.

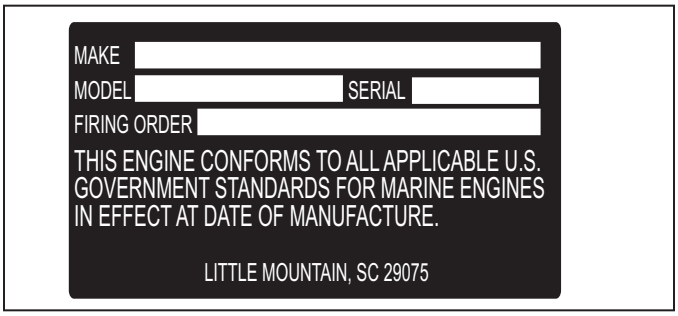

MAKE
MODEL
SERIAL
FIRING ORDER
THIS ENGINE CONFORMS TO ALL APPLICABLE U.S. GOVERNMENT STANDARDS FOR MARINE ENGINES IN EFFECT AT DATE OF MANUFACTURE.
LITTLE MOUNTAIN, SC 29075

Figure 3-1 Engine Identification Decal

OWNER IDENTIFICATION AND REGISTRATION INFORMATION

We suggest that you record the following information for quick reference when ordering parts or requesting service or warranty.

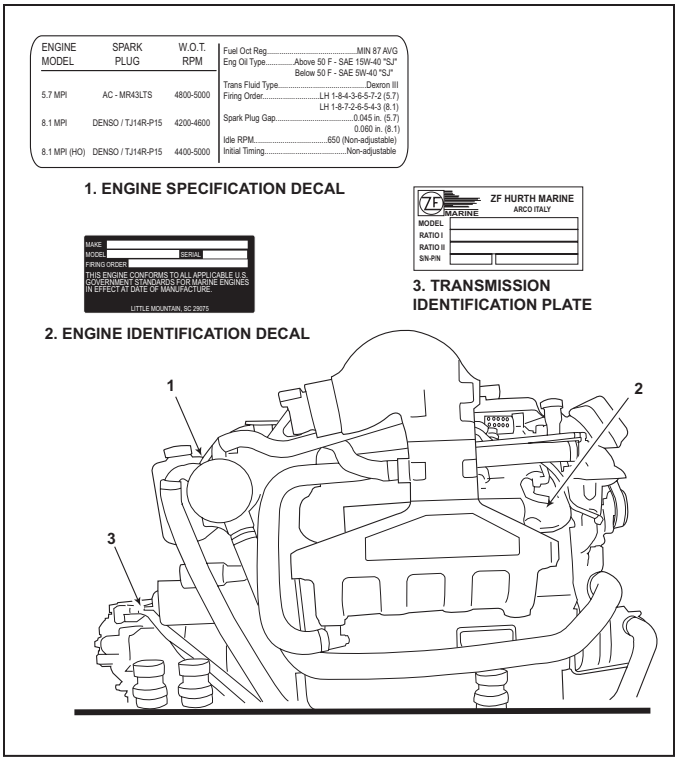


Figure 3-2 Engine Identification Tag Locations (8.1L)

	PORT	STARBOARD
Engine Model Number:		
Serial Number(s):		
Gear Model Number:		
Serial Number(s):		
Boat Make:		
Boat Model:		
Hull Serial Number:		
Propeller Size:		
Ignition Key Number:		

CRUSADER
2004 MODEL IDENTIFICATION / ADVISORY

MODEL **C X L X H F L 245 M** SERIAL **641254**

1st Space: **MANUFACTURER**
C - Crusader

2nd Space: **FACTORY FRESHWATER / CLOSED COOLING**
X-Freshwater Cooled
(Space Omitted If Raw Water Cooled)

3rd Space: **ENGINE ROTATION**
L - Rotation, Left-Hand from Rear
R - Rotation, Right-Hand from Rear

4th Space: **ENGINE TYPE**
A = 5.7L (350 CID HO) (GM)
G = 5.0L (305 CID) (GM)
Q = 6.0L (366 CID) (GM)
X = 8.1L (496 CID STD) (GM)
Z = 8.1L (496 CID HO) (GM)

5th Space: **DRIVE MANUFACTURER**
W - Borg-Warner
H - Hurth
T - Walters
V – Velvet Drive (cast iron units specify 71c or 72c)

6th Space: **DRIVE FUNCTION / APPLICATION**
R - Reverse / Reduction
V - Vee Drive / Reversed Risers
F - Full Reversing

7th Space: **PROPELLER SHAFT ROTATION**
L - Left-Hand Rotation
R - Right-Hand Rotation

8th 9th 10th Spaces: **DRIVE GEAR RATIO OR REDUCTION**
The drive gear ratio will appear in these spaces which identifies the production gear specs. The example gear number shown is a (2.45:1). If the gear being identified does not have 3 digits, a "0" will appear in 10th space.
Example: (2.0:1) will appear as 200
(1.5:1) will appear as 150

***MODELS ENDING WITH "000000" IN PLACE OF DRIVE I.D. ARE BOBTAIL ENGINES.**

11th Space: **IGNITION / FUEL TYPE USED**
D - DISTRIBUTOR (Carb)
E - THROTTLE BODY INJECTION
M - MULTI-PORT FUEL INJECTION

SERIAL NUMBER I.D.
1st DIGIT INDICATES DECADE ENGINE WAS MANUFACTURED (5 = 1990, 6 = 2000, 7 = 2010)
2nd DIGIT INDICATES YEAR ENGINE WAS MANUFACTURED.

ELECTRONIC FUEL INJECTION SYSTEM

The Crusader Marine Engines covered in this manual are equipped with an Electronic Fuel Injection (EFI) system, which allows precise control of fuel and spark delivery. The fuel system components of the EFI system are:

- The electric fuel pump
- The throttle body assembly
- The fuel injectors

The fuel injection system is controlled by an Electronic Control Module (ECM). The ECM is the decision center of the system. The ECM constantly monitors information from various sensors on the engine, and electronically processes the information, in order to control ignition timing and fuel delivery for optimum performance and fuel economy. The ECM incorporates an engine overspeed protection, calibrated to a specific RPM, to prevent engine damage from over-revving.

The sensors that the ECM monitors are:

- Engine Coolant Temperature (ECT) Sensor
- Throttle Position (TP) Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Knock Sensor (KS) System
- Crankshaft Positioning (CKP) Sensor
- Camshaft Positioning (CMP) Sensor
- Intake Air Temperature (IAT) Sensor

If, for any reason, one or more of these sensors or associated wiring malfunctions, the ECM's built-in self-diagnostic system sets a trouble code and turns on the "Check Engine" light (if equipped) to alert the operator of a malfunction.

In most cases, when the "Check Engine" light is on, the engine(s) will lose some performance and/or efficiency, but remain running adequately. Also, the light may go out or become intermittent, but a trouble code will be logged for future diagnosis.

In any case, the operator must obtain service by an authorized dealer to determine the exact cause of the malfunction.

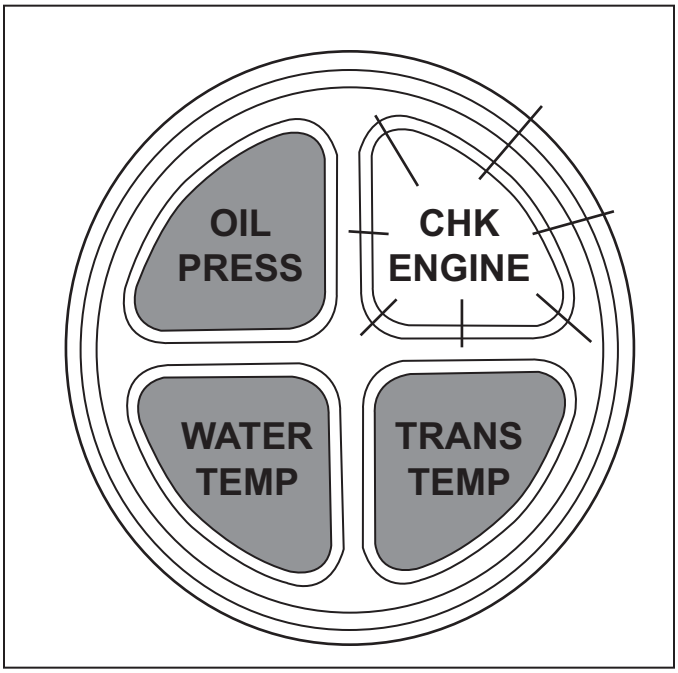


Figure 4-1 Check Engine Light Illuminated

POWER REDUCTION MODE

The ECM monitors engine oil pressure, engine coolant temperature and transmission oil temperature whenever the engine is running. If any one of these inputs indicate an abnormal reading, the system will go into “Power Reduction” mode, followed by the illumination of an indicator lamp and/or sounding of the warning buzzer (if equipped). This is a feature that will help protect the engine or transmission during an over-temp or low oil pressure condition.

When in “Power Reduction” mode, the ECM will allow normal engine performance up to 2000 RPM. Above 2000 RPM, the ECM allows fuel delivery through only half of the fuel injectors. Once the RPM is brought down below 1200 RPM, normal engine operation is restored until the RPM exceeds 2000 RPM. The feature allows maneuverability of the boat while removing the possibility of high engine speed operation until the problem is corrected.

On twin engine applications, if configured correctly by the installer, BOTH engines will be limited to 2000 RPM.

NOTICE: If it is not possible to safely shut off the engine(s), return the engine(s) to idle speed. Once returned to idle, the ECM will allow the engine(s) to operate normally below 2000 RPM.

High Engine Coolant Temperature

During operation, if the engine coolant temperature exceeds normal operating temperature, the engine enters “Power Reduction” mode and illuminates the WATER TEMP portion of the warning light cluster (if equipped). A warning buzzer will also sound (if equipped).

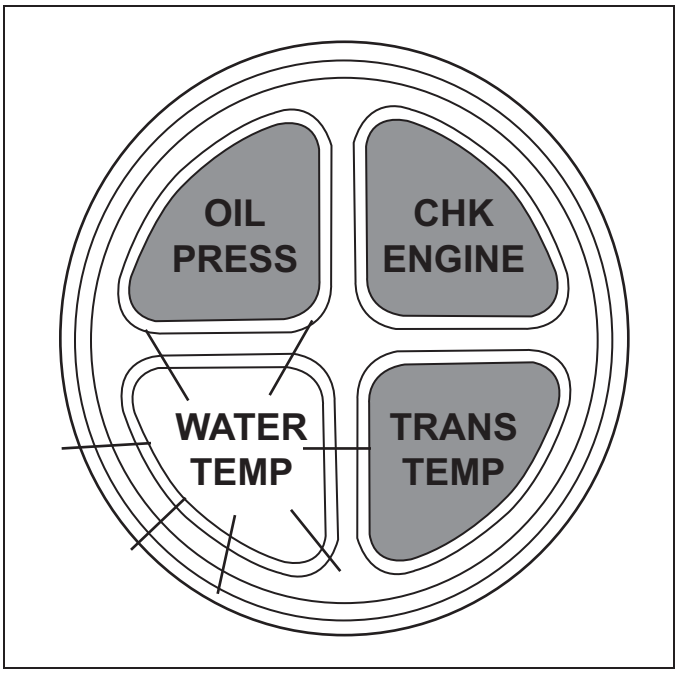


Figure 4-2 WATER TEMP Light Illuminated

Low Engine Oil Pressure

During operation, if the engine oil pressure drops below 10 psi with the engine above 2000 RPM, the engine enters “Power Reduction” mode and illuminates the OIL PRESS portion of the warning light cluster (if equipped). A warning buzzer will also sound (if equipped).

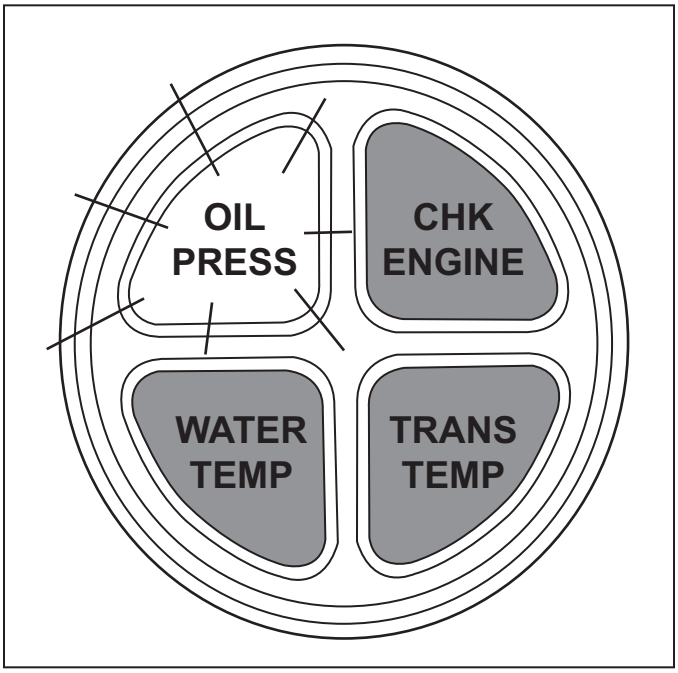


Figure 4-3 OIL PRESS Light Illuminated

High Transmission Fluid Temperature

During operation, if the transmission fluid temperature exceeds 235˚ F (113˚ C), the engine enters “Power Reduction” mode and illuminates the TRANS TEMP portion of the warning light cluster (if equipped). A warning buzzer may also sound (if equipped).

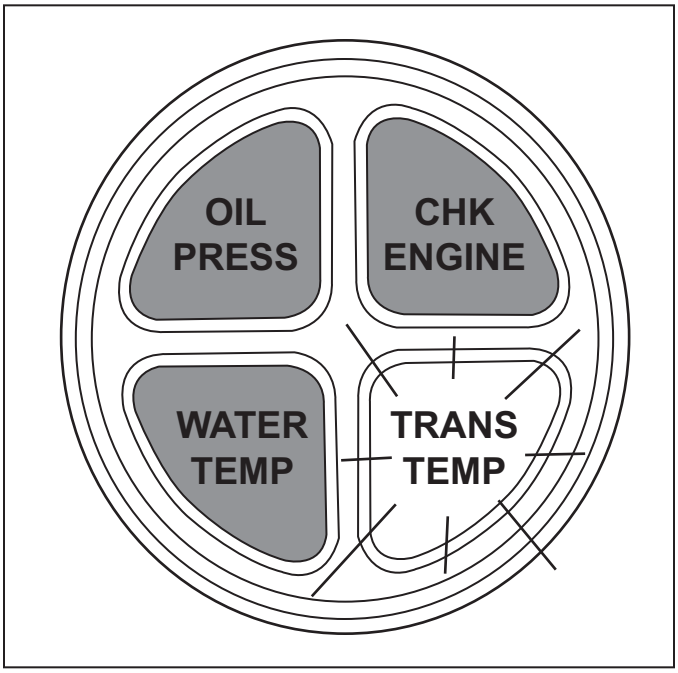


Figure 4-4 TRANS TEMP Light Illuminated

If a problem occurs in any of the aforementioned areas, return the boat to your Crusader Marine Engines Dealer for service.

ENGINE ALARM SYSTEM (OPTIONAL)

The Crusader engine electronic system is programmed to control the engine alarm system. This system utilizes an audible alarm and/or optional indicator lamps to warn the operator of possible engine problems, and that the engine(s) have entered the “Power Reduction” mode as covered earlier in this manual.

The alarm has a “self” checking feature programmed into the system. This feature will sound the alarm for two short pulses upon initial start-up of the engine.

If the alarm sounds during operation, immediately throttle back to idle speed. Observe the indicator lamps to locate the problem circuit. If the boat can be safely navigated with one engine, on twin engine applications, or can be anchored safely, the engine should be shut off to prevent damage to the engine or transmission.

NOTICE: Some boat builders may install their own alarm system. It is recommended that the boat owner check with his or her boat dealer for an explanation of the particular alarm system upon initial delivery.

INSTRUMENTATION

Boat manufacturers install many different types of instrumentation on boats. Become familiar with the instrumentation on your boat and be aware of abnormal operating conditions. The following is a brief explanation of typical instrumentation found on most boats:

1. Tachometer - indicates the engine RPM (revolutions per minute)
2. Engine Synchronizer (twin engines only)
3. Water Temperature Gauge - indicates the engine coolant temperature
4. Oil Pressure Gauge - indicates the engine oil pressure
5. Voltmeter - indicates the battery voltage and charging system voltage
6. Hour Meter - indicates the engine operating time
7. Fuel Level Gauge - indicates the fuel tank level
8. Check Engine Lamp - indicates a problem with the engine control system

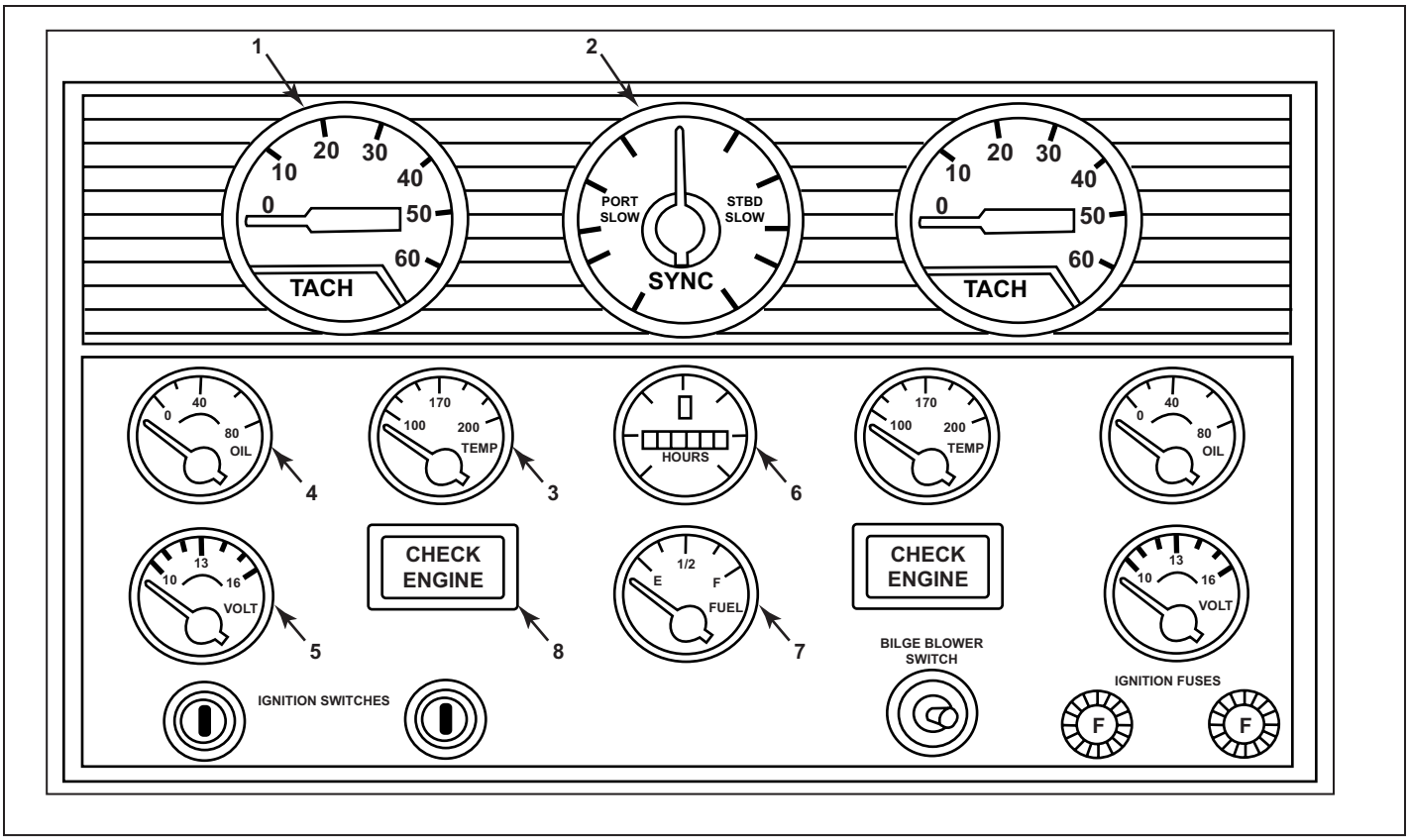


Figure 5-1 Typical Instrument Panel

REMOTE CONTROLS

Your boat may be equipped with one of many different types of remote controls available. Ask you dealer for a description and/or demonstration of the particular type installed on your boat.

CAUTION

Never shift transmission into or out of gear unless throttle is at the idle position. Shifting transmission above 1000 RPM can severely damage boat, transmission and engine.

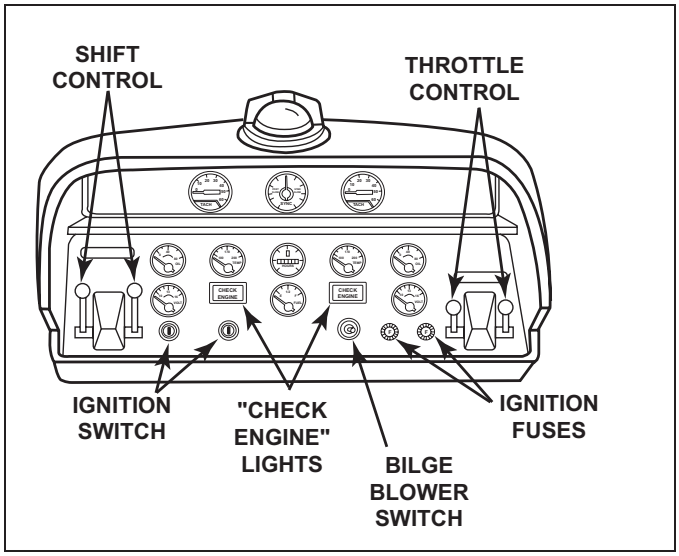


Figure 5-2 Typical Dash Layout

STARTING ENGINE (FUEL INJECTED ENGINES)

WARNING

Electrical, ignition and fuel system components on Crusader Marine Engines are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize risks of fire.

IMPORTANT: Do not start the engine without water being supplied to the sea water pick-up pump or sea-water pump impeller will be damaged, and subsequent overheating damage to the engine may result.

IMPORTANT: The following items should be checked before starting the engine, and each time the boat is operated:

- Fuel system for any signs of leakage
- Operation of remote controls and steering
- Engine and transmission oil levels
- Fuel tank levels
- Exhaust system for leaks and tightness of the clamps
- Battery connections and water level in battery cells
- Accessory drive belt
- Cooling system for leaks. If equipped with fresh-water cooling, check coolant level in recovery bottle. Check for signs of water leaks at the exhaust manifolds, risers and elbows (Figure 5-2A). If the water is leaking externally, it is possible that the water is also leaking internally. This could result in internal engine damage. It is very important to service these maintenance items as soon as a problem is indicated.

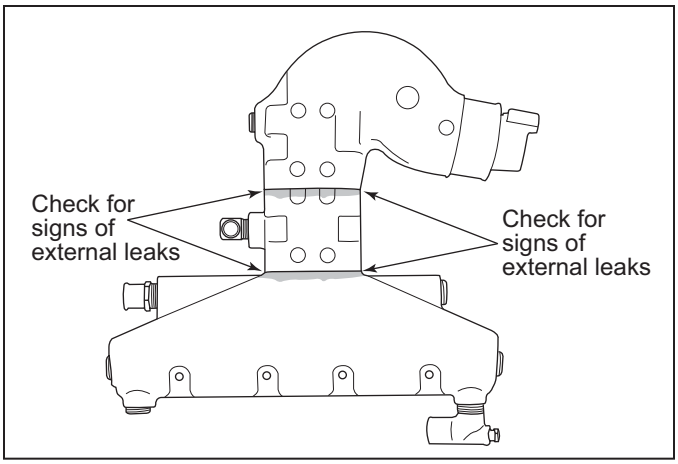


Figure 5-2A Water Leaks

After performing the initial safety checks, proceed as follows to start the engine:

1. Turn the battery switch ON (if equipped).
2. Open the fuel valve.
3. Open the seacock.
4. Place the remote control in Neutral position. The transmission is equipped with a neutral safety switch, which will not allow the starter motor to operate unless the transmission is in neutral.
5. Do not pump or open the throttle when starting the engine (Figure 5-3). The ECM will automatically regulate the fuel and control desired idle speed.
6. Turn the ignition key to the start position. When the engine starts, release the key.

NOTICE: Engine idle speed is controlled by the ECM and is based on the operating temperature of the engine. Upon initial start-up, engine RPM will be slightly higher and will automatically decrease as the engine operating temperature increases.

7. In the event the engine becomes flooded, move the throttle lever to a 100% open position (Figure 5-3). At this throttle position, the ECM will command the injectors to deliver no fuel during engine cranking.

IMPORTANT: If the engine fails to start within 20-30 seconds, turn the ignition key to the OFF position and allow 2 minutes for the starter motor to cool off before attempting to restart the engine.

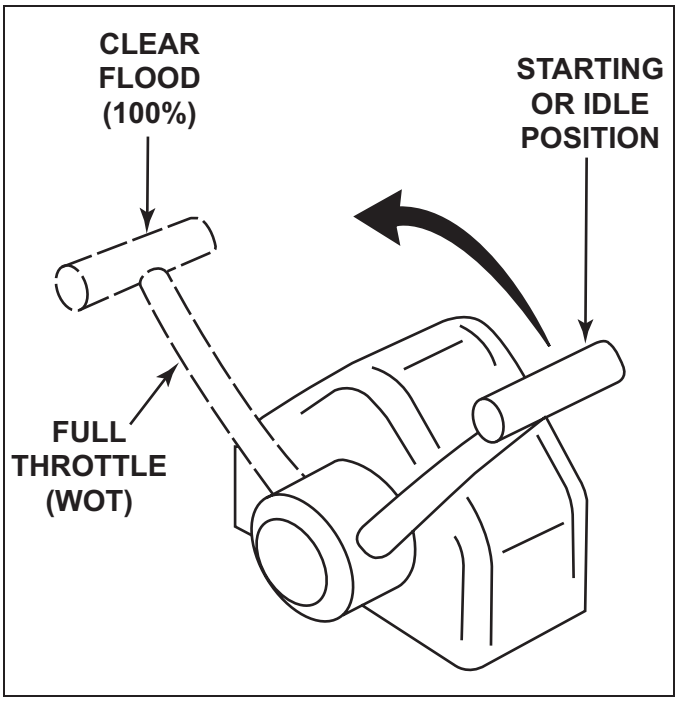


Figure 5-3 Throttle Position Setting

NOTICE: If engine still fails to start, contact your Crusader Marine Engines Dealer for service.

8. Check engine oil pressure immediately after the engine starts. If oil pressure is not within specifications (see Engine Specifications), immediately stop the engine and determine the cause.

9. Check voltmeter for proper charging system operation.

10. Check the engine and transmission for fuel, oil, water and exhaust leaks.

11. Allow the engine to reach normal operating temperature. Check the temperature gauge to ensure the engine is operating within the normal temperature range. If the temperature is abnormally high, stop the engine immediately and determine the cause.

SHIFTING TRANSMISSION

CAUTION

Never shift the transmission into or out of gear unless the throttle is at the idle position. Shifting the transmission above 1000 RPM can severely damage the boat, transmission and engine.

1. Set the throttle lever at the idle position.

2. Move the transmission lever ***completely forward*** to shift into Forward gear.

3. Move the transmission lever ***completely backward*** to shift into Reverse gear.

4. Move the transmission lever to the ***center detent*** position to shift into Neutral.

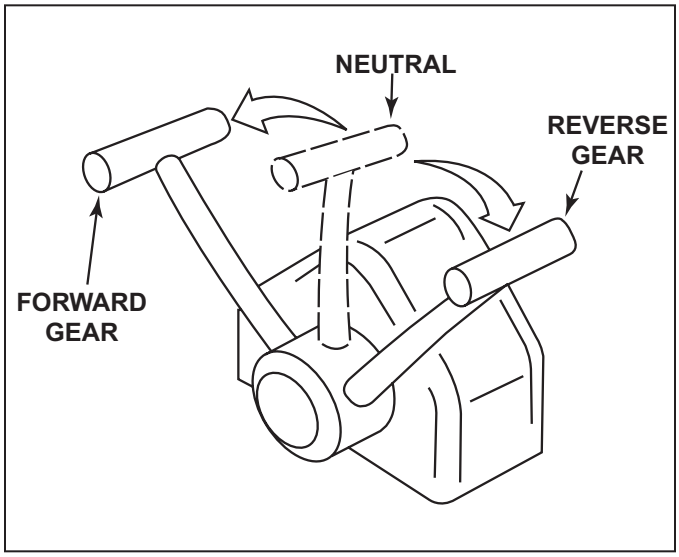


Figure 5-4 Shift Control

STOPPING ENGINE

When returning to the dock, or whenever stopping the engine, bring the throttle back to the idle position. After the engine reaches idle speed, turn the ignition key to the OFF position.

Before stopping the engine after extended high speed operation, allow the engine to idle at 1200 RPM for 3 to 5 minutes to allow the engine to cool down before shutting off the ignition.

After stopping the engine, complete the following:

1. Turn the battery switch OFF, if equipped.
2. Close the fuel valve.
3. Close the seacock.
4. Flush the cooling system if in a salt water area.

FREEZING TEMPERATURE OPERATION

If the possibility of freezing exists, the cooling system must be protected after the engine is shut off to prevent freeze damage to the engine. Refer to OUT-OF-SEASON STORAGE for draining instructions.

OPERATION IN HIGH DEBRIS AREAS

If the boat is to be operated in high debris areas, a sea strainer should be installed in the water inlet hose to prevent debris from entering the cooling system. The strainer used must be of sufficient size to allow an adequate supply of water for cooling the engine. A minimum of 30 gallons per minute (114 liters per minute) flow rate is required.

TRIM AND WEIGHT DISTRIBUTION

Trimming of the boat and positioning of the weight (gear and passengers) inside the boat has the following effects on handling:

- Trimming the bow up or shifting weight to the stern (rear).
  - Normally used for cruising (running) with a choppy wave condition (following sea) for running at full speed
  - Will generally increase speed and engine RPM
  - Will cause the bow to bounce in rough water
  - In extreme, may cause the boat to porpoise
  - When coming off plane, it increases the chances of following wave splashing into the stern of the boat
- Trimming the bow down or shifting the weight to the bow (front)
  - Normally used for cruising (running) against a choppy wave condition, acceleration onto plane and operating at slow planing speeds
  - Will improve rough water ride and handling
  - In extreme, may cause the boat to bow steer (veer back and forth with little control)

BOAT BOTTOM

To ensure maximum engine performance, fuel economy and boat speed, the bottom of your boat must be kept clean and free of marine growth and barnacles. Marine vegetation may accumulate when the boat is docked and should be removed before operation. If the boat is docked for long periods of time, the water inlets may become clogged with growth and will cause the engine to overheat.

In most areas, it is advisable to coat the boat bottom with antifouling paint to prevent the build-up of marine growth. Contact your dealer for advice on these requirements in your area.

PROPELLER SELECTION

Best all-around performance and maximum engine life is achieved when the engine is propped to run near the top of (but within) the recommended full throttle RPM range with a normal load. See ENGINE SPECIFICATIONS for rated full throttle RPM for your model engine.

Generally, gross weight (total weight of the entire boat, including full fuel and water, optional equipment, passengers and other miscellaneous gear) is one of the major factors and should be one of the primary considerations when selecting a propeller. Other factors to take into consideration are as follows:

- Warmer weather and higher humidity will cause an RPM loss.
- Operating the boat in a higher elevation will cause an RPM loss.
- Operating the boat with an increased load will cause an RPM loss (additional equipment, passengers, etc.).

If full throttle RPM is above or below the recommended range as stated in ENGINE SPECIFICATIONS, the propeller must be changed to prevent loss of performance. A one-inch change in either the pitch or diameter of a given propeller will generally change engine RPM by 150 to 250 RPM.

ENGINE RPM CHART

Model	Minimum Full Load	Preferred	Maximum
MP 5.0L	4600	4800	5000
MP 5.7L	4800	5000	5200
MP 6.0L	4800	5200	5300
MP 8.1L (STD)	4400	4600	4800
MP 8.1L (H.O.)	4800	5000	5200

CAUTION

Prolonged WOT operation will shorten the life of your engine and could cause premature engine failure. See NORMAL CRUISING SPEEDS in SPECIFICATIONS. Problems caused by WOT operation are considered abuse and are not covered under the Crusader Warranty.

NOTICE: These engines incorporate an RPM “REV LIMIT” in order to prevent the engine from over-revving.

WARNING

Use this procedure ONLY when conditions are such that it can be done in complete safety.

The break-in period of your engine is the first 25 hours of operation. Proper engine break-in is essential to achieve maximum performance, longevity and minimum oil consumption. During the break-in period, the following operation guidelines must be adhered to:

- After the engine is thoroughly warmed up, and the boat is underway, open the throttle to wide open throttle until maximum RPM is reached. DO NOT EXCEED MAXIMUM RPM. (RPM should cease climbing after 10 to 20 seconds).

CAUTION

DO NOT operate at full throttle in neutral at any time, or at sustained full throttle during the first 5 hours of operation. Thereafter, use sustained wide open throttle in the event of an emergency.

- Reduce the throttle to 2800 - 3000 RPM, and cruise at or below this speed for 1/2 hour. Reduce the speed to idle. Go to wide open throttle until maximum RPM is reached and operate for approximately 1 minute. Reduce throttle to 2800-3000 RPM and operate for a few minutes. (Bringing the engine speed from idle to wide open throttle will load the engine and assist in seating the piston rings.) This cycle should be repeated from time to time during the first 5 hours of operation, but wide open throttle should not be sustained for more than 1 minute.

- During the remaining 20 hours of break in period, the engines can be run at cruise speeds that are approximately 75-80% of the wide open throttle RPM, occasionally varying the cruise speed by 100 RPM.

- During the early part of the break in period, the correct propeller selection can be confirmed. (With a normal load aboard, the engine's RPM should reach, but not exceed, the maximum RPM as listed in the specifications section.)

- During the break in, all gauges should be watched carefully, and the speed should be reduced if abnormal readings become evident.

CAUTION

DO NOT attempt to break in any engine by prolong idling, or running at the dock.

The engine oil level should be checked often and oil added when necessary. It must be understood that every internal combustion engine will use a certain amount of oil during operation to act as a lubricating and cooling agent, especially during the break-in period. Oil consumption should decrease and become stabilized after approximately 100 hours of operation.

At the end of your 25-hour break-in period, contact your dealer and have the recommended 25-hour inspection done.

NOTICE: Crusader Marine Engines assumes no responsibility for the costs related to the 25-hour inspection. This is the owner's responsibility.

25-HOUR ENGINE INSPECTION - 8

After the first 25 hours of operation, it is recommended that the engine be given an inspection. Your boat dealer or a Crusader servicing dealer should be contacted to perform the necessary checks and adjustments to ensure the proper engine performance. The following maintenance should be performed:

- Change the engine oil and filter.
- Check and clean the primary fuel filter (returnless design fuel system only).
- Check the engine alignment.
- Inspect the accessory drive belt(s) and check the tension.
- Check all the fluid levels.
- Check the throttle and the shift cable adjustments and check for freedom of movement.
- Cooling System - Inspect all the hoses for leaks, damage and deterioration. Check all the hose clamps for adequate tightness.
- Exhaust System - Inspect the entire exhaust system for leaks, damage and deterioration. Check all the hose clamps for adequate tightness.
- Battery - Check the electrolyte level and specific gravity. Inspect the case for damage. Check the battery cables and connections.
- Engine Assembly - Check for loose, missing or damaged parts. Pay close attention to engine mounts, starter and alternator mounting fasteners.

NOTICE: Crusader Marine Engines assumes no responsibility for the costs related to the 25-hour inspection. This is the owner's responsibility.

GASOLINE REQUIREMENTS

WARRANTY NOTICE: Damage caused to the engine through the use of improper gasoline, low-quality or gasoline with an octane rating below the minimum requirements listed below, is considered misuse of the engine. Such damage is not covered by the Crusader Marine Engines warranty.

The ignition timing set by the factory requires the use of a high-quality lead-free regular gasoline with the following octane specification.

Pump Octane Number (R+M/2) (PUMP) - 87

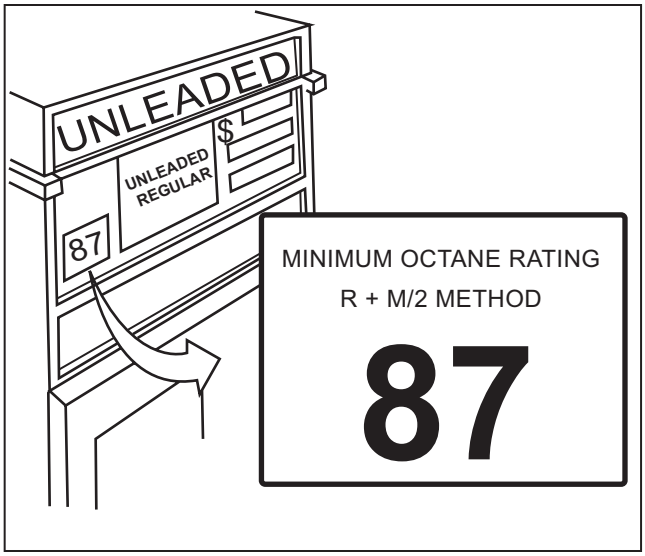


Figure 9-1 Fuel Requirements

NOTICE: Most Crusader Fuel Injected engines are calibrated to operate on 87 octane fuel and maximum performance is obtained when using this fuel. Some applications may require a higher octane fuel. These particular applications will be noted.

If a slight pinging is heard during acceleration and the proper octane fuel is being used, it is considered normal. If a constant, heavy knock occurs, the engine should be evaluated by a Crusader Marine Engines service technician.

GASOLINE CONTAINING ALCOHOL

Gasoline containing alcohol, either ethanol (ethyl alcohol) or methanol (methyl alcohol) is not recommended for use in your engine. Gasoline containing alcohol will attract and hold moisture and may cause the following:

- Hard starting and operating difficulties (vapor lock, low speed stalling)
- Corrosion of metal parts
- Excessive wear and damage to internal engine parts
- Fuel permeation through flexible fuel lines
- Deterioration of some nonmetallic materials

The adverse effects of alcohol are more severe with methanol and are worse with increasing alcohol content.

If gasoline containing alcohol is used, or if the presence of alcohol is uncertain, more frequent inspections of the complete fuel system are required. Any sign of fuel leakage or deterioration must be repaired immediately before further engine operation.

CAUTION

Fire and Explosion Hazard - Gasoline is extremely flammable and highly explosive, and , if ignited, can cause serious bodily injury or death. Careful inspection of the entire fuel system including, but not limited to, fuel tanks, fuel lines, fuel filters and all fittings is mandatory, especially after periods of storage. Replace any component that shows signs of leakage, corrosion, deterioration, swelling, hardening or softening.

NOTICE: Some gasolines contain an octane-enhancing additive called methylcyclopentadlenyl manganese tricarbonyl (MMT), and they should not be used. These fuels may reduce spark plug life, and engine performance may be effected.

OIL REQUIREMENTS - 10

ENGINE OIL RECOMMENDATIONS

Use of Supplemental Additives

Engine oils meeting Crusader Marine Engines' recommendations already contain a balanced additive treatment. The use of supplemental additives which are added to the engine oil by the customer are unnecessary and may be harmful. Crusader Marine Engines does not review, approve or recommend such products.

Synthetic Oils

Synthetic engine oils are not recommended for use in Crusader Marine Engines. Synthetics may offer advantages in cold temperature pumpability and high temperature oxidation-resistance. However, synthetic oils have not proven to provide operational or economic benefits over conventional petroleum-based oils in Crusader Marine Engines. Their use does not permit the extension of oil change intervals.

Engine Oil Requirements

The following chart shows the recommended oil viscosity for various ambient temperature ranges:

Prevailing Ambient Temperature	Recommended A.P.I. Classification & Viscosity
Above 50˚F	SAE 15W-40 "SJ"
Below 50˚F	SAE 5W-30 "SJ"

IMPORTANT: The use of oils which contain "solid" additives, non-detergent oils or low quality oils specifically are not recommended.

WARRANTY NOTICE: Crusader Marine Engines reserves the right to refuse warranty on part(s) and/or engine(s) damaged by using improper fuels and engine oils.

Oil Change Intervals (Common)

Crankcase oil and oil filter change - Recommended intervals:

- Initial oil change - 1st 60 days or 25 hours of operation, whichever occurs first
- Regular oil changes - Every 50 hours of operation or 120 days, whichever occurs first

TRANSMISSION AND "V"-DRIVE OIL REQUIREMENTS

Transmission and "V" Drive	Recommended A.P.I. Classification and Viscosity
Velvet Drive Transmissions and "V" Drives - All	Dexron III Automatic Transmission Fluid (ATF) or equivalent
Walters "V"-Drive	Exxon Spartan EP-68 or SAE 30 Engine Oil
All Hurth Gear Transmissions	Dexron III Automatic Transmission Fluid (ATF) or equivalent

NOTICE: WALTERS "V"-DRIVES ONLY - A low oil pressure warning light is mounted on Walters "V"-Drives. The warning light will stay illuminated until the boat gets underway, and the engine speed increases to sufficient RPM for the pump to maintain pressure. This normally occurs at approximately 1200 RPM. Extended cruising at low RPM, such as when trolling, is not harmful to the "V"-drive, even though the warning light may remain illuminated.

ENGINE MAINTENANCE

Refer to the MAINTENANCE SCHEDULE for a complete listing of required maintenance and the frequency at which it should be performed. Some procedures may be performed by the owner/operator while others should be performed by an authorized Crusader Marine Engines Dealer. Before performing any maintenance or repair procedure not covered in this manual, it is strongly recommended that a Crusader Marine Engines repair manual be purchased and read thoroughly.

CHECKING FLUID LEVELS

Engine Crankcase Oil

CAUTION

Do not overfill engine crankcase with oil, as excess oil will be splashed by reciprocating engine parts onto the cylinder walls in greater quantity than the rings can control. The oil, subsequently, will be drawn into the combustion chamber and burned. Continuous operation under these conditions can cause carbon to form on combustion chamber surfaces, which will adversely affect engine performance and may lead to premature engine failure. Splashing or agitation of oil also may cause it to become aerated, which will affect the oil pressure, and may result in internal engine damage from lack of lubrication.

1. Stop the engine if running. Allow approximately 5 minutes for the oil to drain back into the oil pan.

2. Remove the dipstick, wipe it clean, and reinstall it fully into the dipstick tube.

3. Remove the dipstick and observe the oil level. The oil level must be between the “FULL” and “ADD” marks. If the oil level is below the “ADD” mark, add specified oil to bring the level up to, but not over, the “FULL” mark on the dipstick. (Figure 11-1).

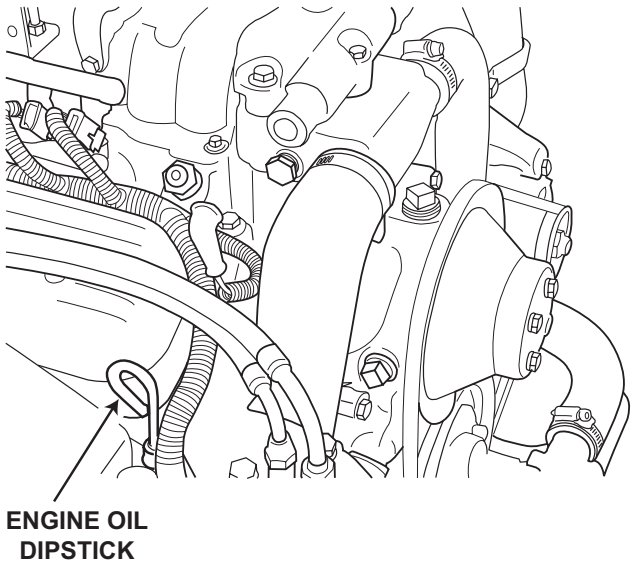


Figure 11-1 Engine Oil Dipstick (Typical)

WARNING

The machinery space must be closed anytime the engine is running to prevent injury to you or others on board. Never operate the engine while someone is in the machinery space, either closed or open. Never open the machinery space unless the engine is shut off and the engines rotating parts are stationary. Rotating machinery can cause injury and even death if an accident should occur. Extreme care must be exercised if a problem exists that requires operation of the engine with the machinery space open. ***IT IS RECOMMENDED THAT UNCOVERED ENGINE OPERATION BE ATTEMPTED BY TRAINED AND QUALIFIED SERVICE PERSONNEL ONLY.***

Transmission Fluid

CAUTION

Crusader Marine Engines uses marine transmissions supplied by several manufacturers. The maintenance requirements can be different between these manufacturers. It is important that you refer to the operation and maintenance manual supplied by the transmission manufacturer before you attempt to perform maintenance on your own. If no maintenance manual is available, Crusader Marine Engines recommends that you contact your dealer service department for any required maintenance or service instructions.

1. Remove the dipstick by turning the T-handle counterclockwise. Observe the fluid level. Replace the dipstick and tighten securely.

WARNING

Do not attempt to remove the transmission dipstick while the engine is running. Hot transmission fluid could be sprayed from the dipstick hole.

2. Operate the engine until the engine and the transmission reach operating temperature.

3. Stop the engine and quickly check the fluid level to minimize the drain-back from the oil cooler. Remove the dipstick by turning the T-handle counterclockwise. Observe the fluid level.

4. The fluid level should be at the “FULL” or “MAX” mark. If low, add the specified fluid through the dipstick tube. Repeat checking procedures as required until the fluid level is at the “FULL” or “MAX” mark.

5. Replace the dipstick and tighten securely.

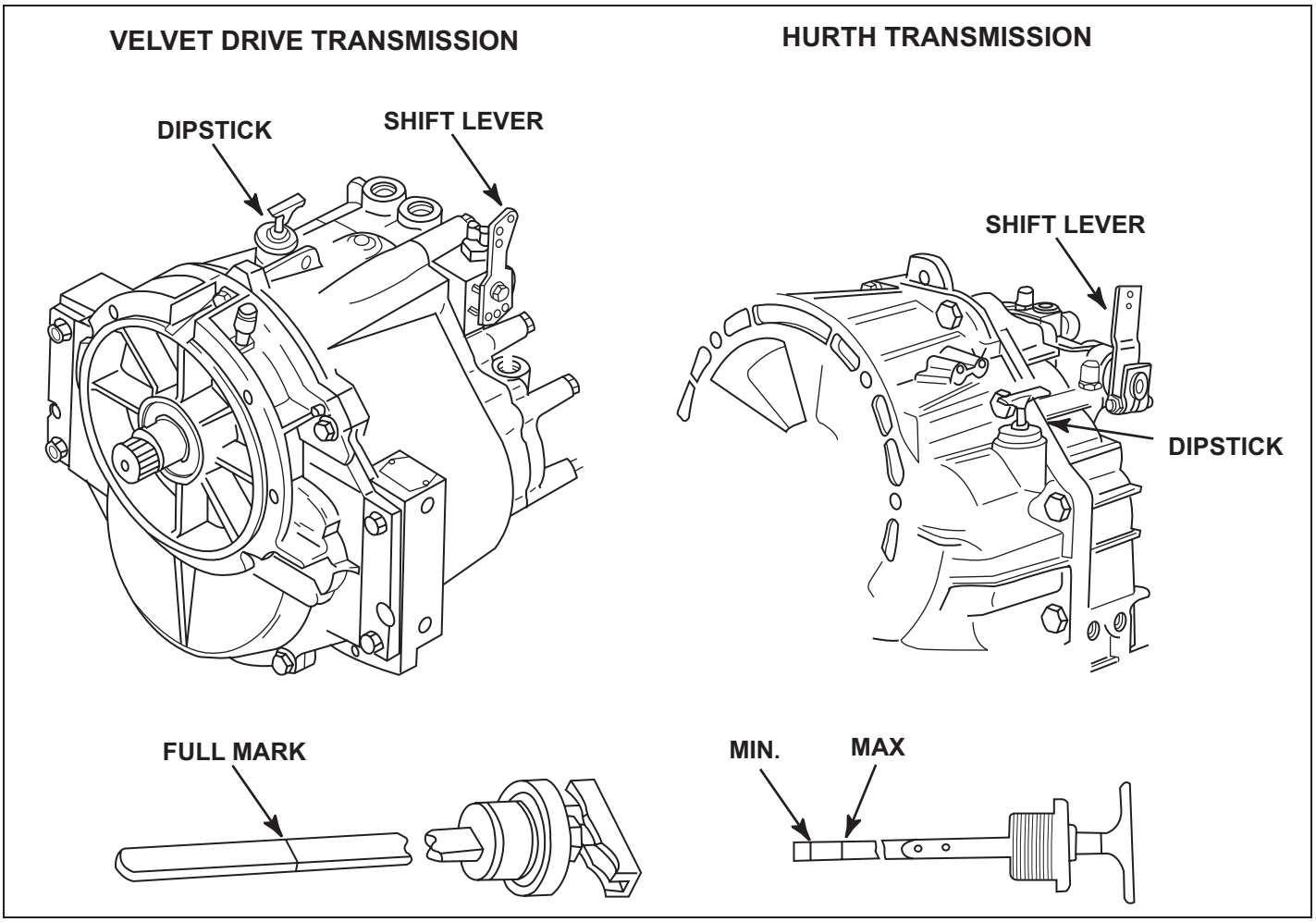


Figure 11-2 Transmission Dipstick and Location

LUBRICATION

Throttle Cable

Lubricate pivot points and exposed cable (Figure 11-3) with SAE 30W-30 engine oil.

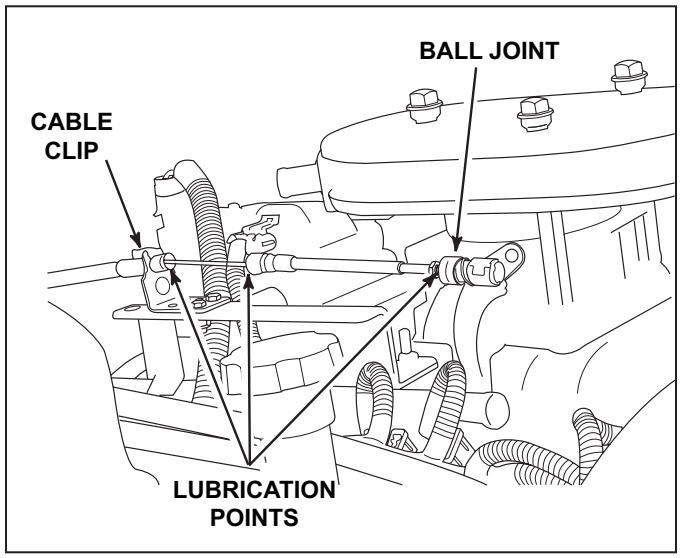


Figure 11-3 Typical Throttle Cable

Shift Lever

All Velvet Drive Transmissions - Lubricate the detent ball and holes in shift lever (Figure 11-4) with white grease (Lubriplate or equivalent).

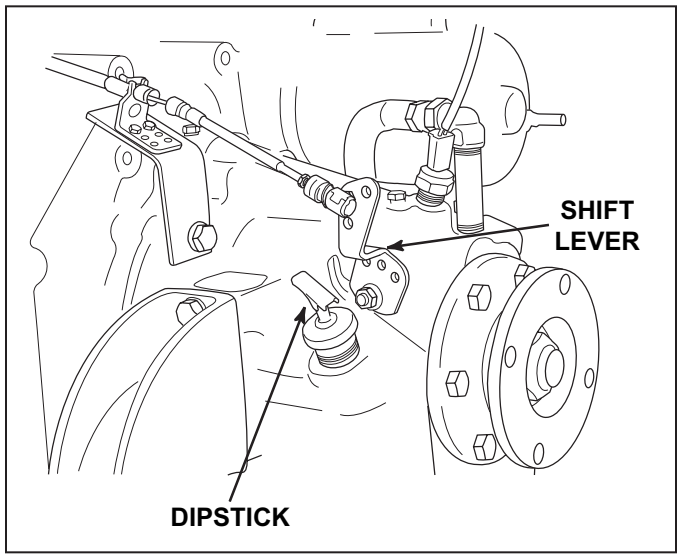


Figure 11-4 Transmission Shift Lever - Velvet Drive 5000

Shift Cable

Lubricate pivot points and exposed cable (Figure 11-5) with SAE 30W-30 engine oil.

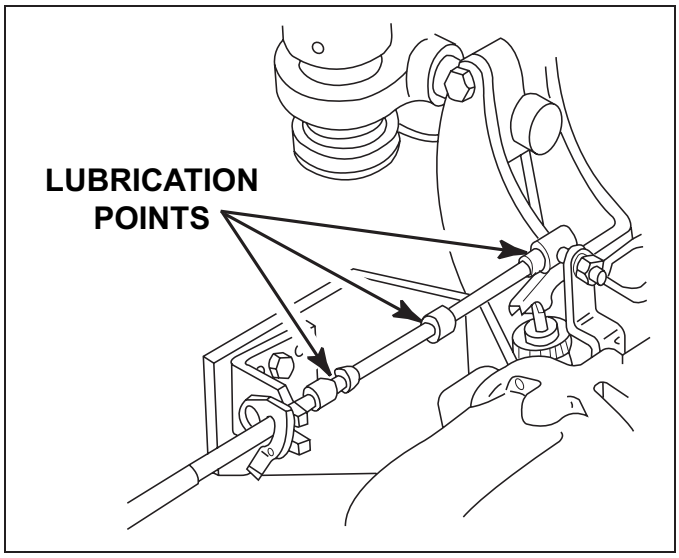


Figure 11-5 Typical Shift Cable

ELECTRICAL SYSTEM CIRCUIT BREAKER

Main Circuit Breaker

Crusader engines are equipped with a circuit breaker which provides electrical overload protection for both engine and instrumentation wiring and components. Should an electrical overload occur, the circuit breaker will open and prevent electrical current flow.

When this circuit breaker opens, the cause for the high current draw must be found and corrected. The circuit breaker can be reset by pushing the “Reset” button IN after waiting a few minutes. If the cause of the overload cannot be found, disconnect all accessories which are connected to the main wire harness.

If resetting is still not possible, check the battery and alternator connections and all other harness connectors on the main harness. Check for loose or disconnected lead wires and shorted circuits.

ELECTRICAL SYSTEM FUSES

Crusader engines utilize fuses to control the fuel pump, ECM and fuel injectors. The fuse block is mounted to a bracket near the exhaust elbow under a weather-tight cover.

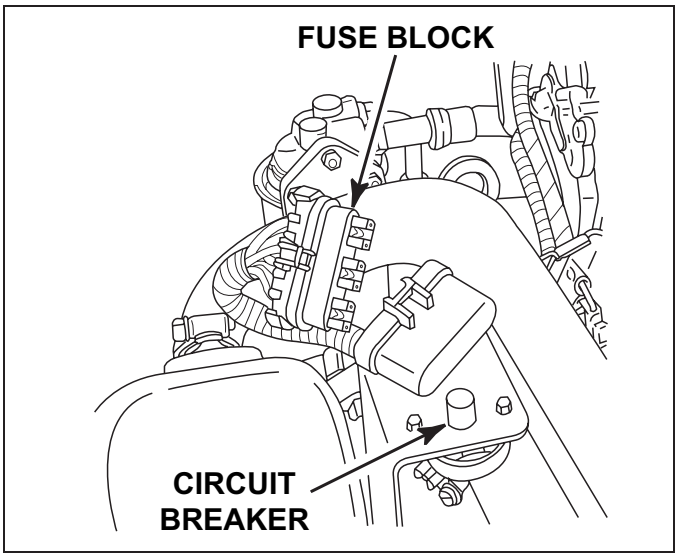


Figure 11-6 Typical Electrical System Circuit Breaker and Fuses

IGNITION FUSE

If the engine will not crank when the ignition key is turned to the START position, first check that the shift lever is in neutral position. If the main circuit breaker is not tripped, check for blown ignition fuse. The ignition fuse may be located on the instrument panel, the fuse holder block or as part of the instrument wiring harness. Check the wiring diagrams supplied from the boat manufacturer for the exact location.

ELECTRICAL SYSTEM WIRING AND CONNECTORS

The electrical system wiring and connectors should be checked periodically for loose or dirty connections and damaged wiring. If electrical components or wiring show signs of corrosion, deterioration or damage, consult a Crusader Marine Engines dealer to make necessary repairs.

BATTERY

WARNING

Battery electrolyte is a corrosive acid and should be handled with care. If electrolyte is spilled or splashed on any part of the body, IMMEDIATELY flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible. Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte.

WARNING

Hydrogen gases that escape from the battery when charging are highly explosive. Do not use jumper cables and a booster battery to start the engine. Do not recharge a weak battery in the boat. Remove the battery from the boat and recharge in a well ventilated area away from fuel vapors, sparks and open flames.

Follow maintenance instructions and warnings as supplied by the battery manufacturer. If this information is not available, follow these guidelines for the proper battery care.

- Do not operate the engine with an open in the battery circuit, as this may cause damage to the alternator. Make sure that all connections are clean and secure.
- When removing the battery cables, always remove negative (-) cable first, and then remove the positive (+) cable. When installing battery cables, install the positive (+) cable first, then install the negative (-) cable.
- Periodically check the battery for signs of corrosion, frayed battery leads or cracked case. Repair or replace as necessary.
- Periodically check the electrolyte level. Add distilled water to bring up to the proper levels.

FRESH-WATER COOLING SYSTEM SACRIFICIAL ZINC ANODE

Located in the raw water side of the heat exchanger is a zinc anode which is marked by a decal. To check, remove the plug and visually check the condition of the zinc rod. The length of the zinc rod when new is approximately 1.5 inches. If more than one half of the zinc is gone, replace with a new zinc anode.

Different geographic locations and water make-up can result in either high or low sacrificial requirements. A high rate of zinc anode consumption should also alert the owner to a possibility of an improperly wired boat accessory, which would require complete checking by qualified service personnel.

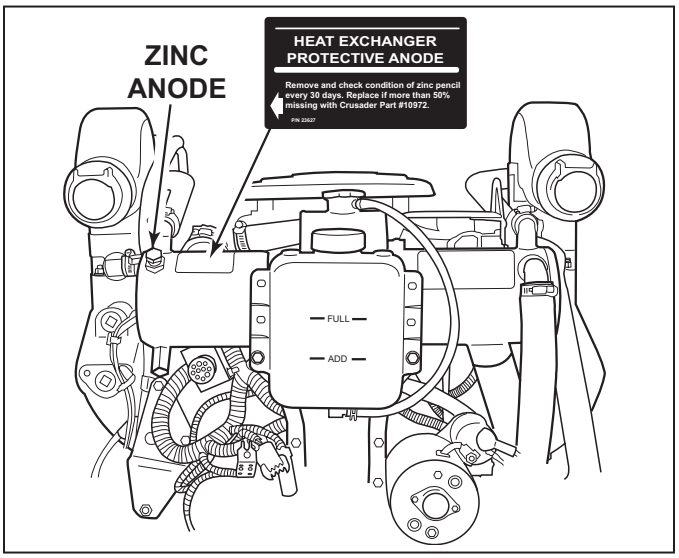


Figure 11-7 Zinc Anode Location 8.1L F.W.C. Heat Exchanger

CHECKING COOLANT LEVEL

WARNING

Do not remove cooling system filler cap when the engine is hot. Allow the engine to cool and then remove the pressure cap slowly, allowing the pressure to vent. Hot coolant, under pressure, may discharge violently and cause severe burns.

Coolant Recovery Reservoir

The “see-through” plastic reservoir is connected to the heat exchanger by a small hose. The recovery bottle collects coolant that expands with rising temperature, and would otherwise overflow from the system. Coolant level should be at or slightly above the “ADD” mark on the bottle when the system is cold. Coolant should be added ONLY to the reservoir when the system cools.

Coolant Filler Neck

Periodically, on a cool engine, remove the pressure cap from the filler neck to ensure the coolant recovery system is functioning properly. Coolant must be at the top of the filler neck. If coolant is low, check the gasket in the cap for damage. Replace if necessary. Inspect the coolant recovery system for leaks.

DeGas Bottle

The “see-through” degas bottle is connected to the heat exchanger by a small hose. The degas bottle collects coolant that expands with rising temperature, and would otherwise overflow from the system. Coolant level should be at or slightly above the “ADD” mark on the bottle when the system is cold. Coolant should be added ONLY to the bottle when the system cools.

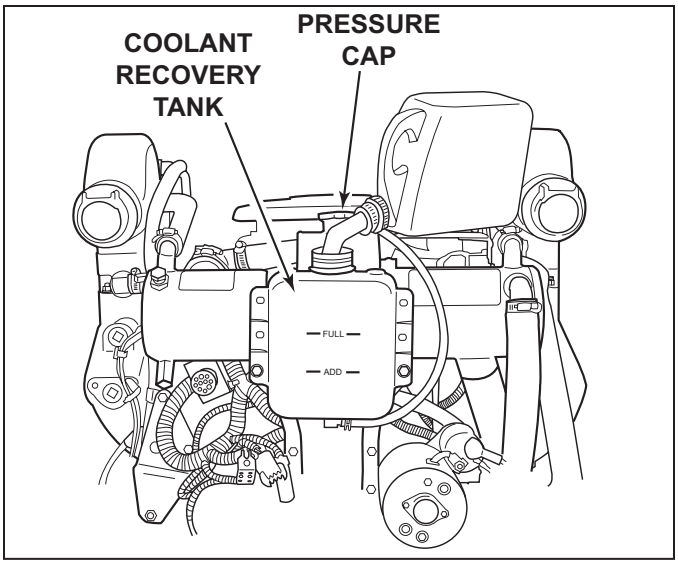


Figure 11-8 Checking Coolant Level (8.1L)

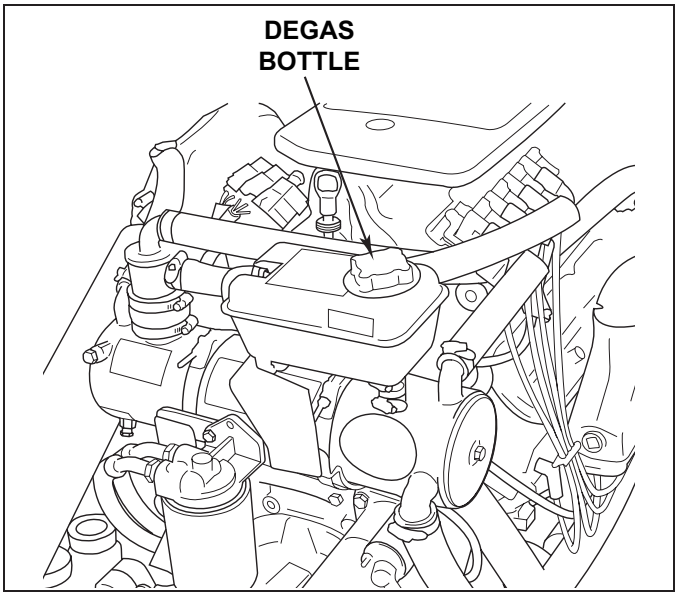


Figure 11-8 Checking Coolant Level (6.0L)

FLUSHING COOLING SYSTEM - SEA-WATER SECTION

To prevent silt and/or salt build-up in the cooling system (fresh or raw-water cooled), flush the sea-water section of the cooling system with fresh water at specified intervals.

CAUTION

Do not operate the engine without water being supplied to the sea-water pump. The sea-water pump impeller may be damaged and subsequent overheating damage may result.

CAUTION

Do not run the engine above 1500 RPM when flushing. Suction created by the sea-water pump may collapse the flushing hose, causing the engine to overheat. Watch the temperature gauge while flushing to ensure the engine does not overheat.

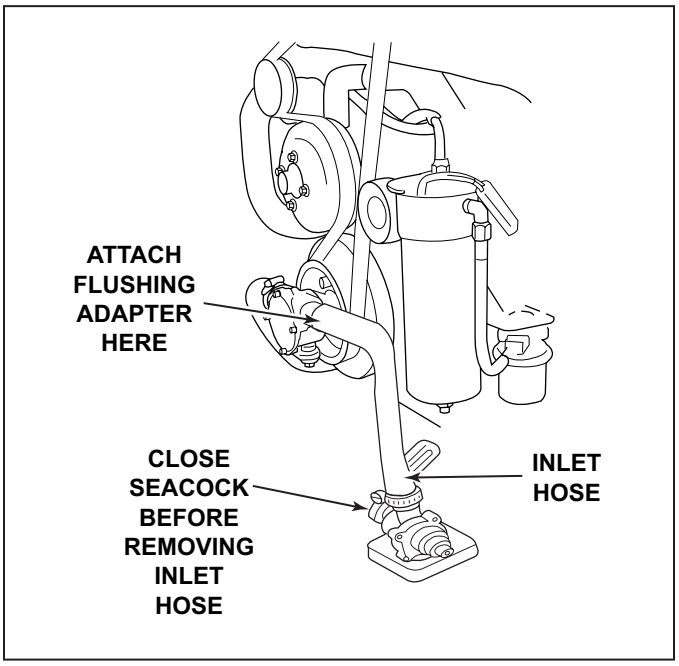


Figure 11-9 Typical Sea-Water Inlet

TESTING COOLANT FOR ALKALINITY

It is recommended that the coolant in the fresh-water section be tested each year for alkalinity. Coolant that is not alkaline has lost the effectiveness of its rust inhibitors, which can lead to internal corrosion and cooling system problems. It is recommended to replace the extended life engine coolant, known as DEX-COOL™, in the system every five years to prevent a build-up of harmful chemicals within the fresh-water system.

1. Obtain red litmus paper from a local supplier (drugstore, laboratory, etc.).

2. Remove the pressure cap from the coolant filler neck and insert one end of the litmus paper into the coolant.

3. If red litmus paper turns blue, coolant is alkaline and does not need to be replaced. If the litmus paper remains red, the coolant is not alkaline and must be replaced.

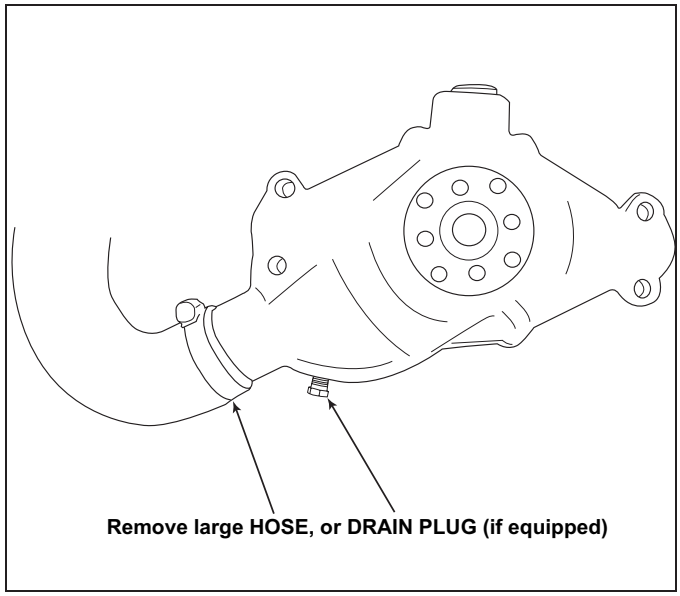


Figure 11-10 Draining Engine Circulating Pump (5.0/5.7L)

DRAINING FRESH-WATER COOLING SYSTEM

NOTICE: To protect the environment, dispose of coolant properly. Check your local restrictions for proper disposal instructions of removed coolant.

NOTICE: Refer to cooling system water flow diagrams for drain locations.

1. Remove the following drain plugs to drain coolant from the fresh-water cooling system:
   - Drain plug on heat exchanger
   - The hose and/or drain plugs from the fitting on the bottom of the exhaust manifolds (one on each side)
   - Drain plugs from risers
   - Drain plugs on the cylinder block (one on each side)
   - Remove the large hose from the engine block water circulating pump, or drain plug on circulation pump. (See Figure 11-10.)

2. Remove the following drain plugs to drain raw water from the fresh-water cooling system:
   - Drain plug on oil cooler
   - Drain plug on heat exchanger
   - Drain plug on fuel cooler canister (returnless fuel system only)

3. After system has drained completely, coat all the drain plugs with PerfectSeal (or equivalent) and reinstall in the proper locations. Reinstall the hose(s) on the water circulating pump and the exhaust manifolds and tighten the clamps securely.

FILLING FRESH-WATER COOLING SYSTEM

A new extended life engine coolant known as DEX-COOL™ is used in your engine(s). It is imperative to note the following about DEX-COOL™ engine coolant:

- IT IS PINK IN COLOR TO DISTINGUISH IT FROM CONVENTIONAL COOLANT.
- THE SERVICE CHANGE INTERVAL ON ENGINES BUILT WITH DEX-COOL™ IS 5 YEARS.
- TO MAINTAIN FULL CORROSION PROTECTION DURABILITY, DEX-COOL™ MUST NOT BE MIXED WITH CONVENTIONAL (CONTAINING SILICATE) ENGINE COOLANTS.
- DEX-COOL™ IS AN ETHYLENE GLYCOL BASED PRODUCT, THEREFORE, BOIL AND FREEZE PROTECTION ARE MEASURED IN THE SAME FASHION AS CONVENTIONAL COOLANTS.

TO FULLY REALIZE ITS MANY ADVANTAGES, DEX-COOL™ MUST NEVER BE MIXED WITH CONVENTIONAL COOLANTS.

DEX-COOL™ can become contaminated by inadvertently topping-off with conventional coolant, adding conventional coolant to the system or even if fill/drain containers are shared between coolants. If contamination occurs, the cooling system must be immediately drained and flushed, and refilled with DEX-COOL™. No short-term damage will occur, however, the service interval will be reduced from 5 years to 2 years.

The fresh-water cooling side of the cooling system must be filled with a 50/50 mixture of DEX-COOL™ (or equivalent, which meets GM6277M) extended life antifreeze and water solution.

IMPORTANT: More than 50% antifreeze solution can contribute to an overheating condition.

IMPORTANT: If the engine is being placed in winter storage, the fresh-water cooling section must be filled with a correct type of coolant and water solution, properly mixed, to protect the engine to the lowest temperature to which it will be exposed.

1. Make sure that all drain plugs are properly installed.
2. Remove the pressure cap from the filler riser, located on the intake manifold.
3. Fill the system with antifreeze solution until the system is filled. See ENGINE FLUID CAPACITIES for system capacities.
4. Start the engine and operate at idle speed (800-1000 RPM) to purge any air from the system. When the coolant level remains constant in the filler riser, install the pressure cap on the riser.
5. Add additional coolant into the coolant recovery tank to the “ADD” level.
6. Continue to run the engine until it reaches normal operating temperature. Check the coolant recovery tank for the proper level and add coolant if necessary.

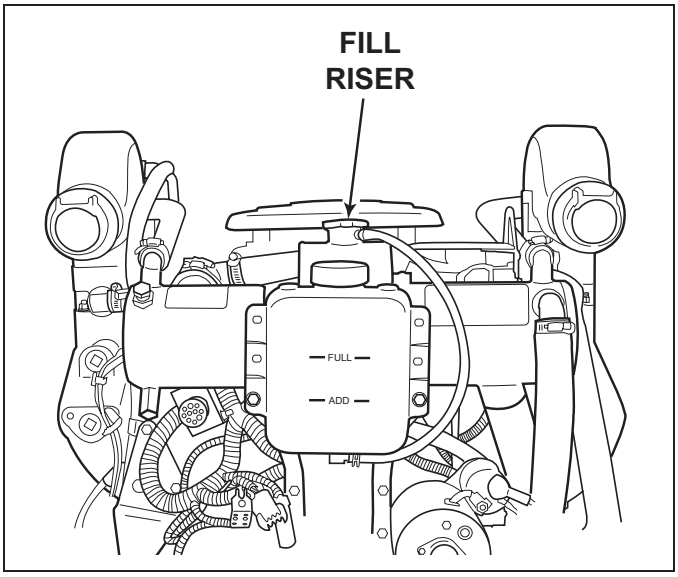


Figure 11-11 F.W.C. Fill Riser Location

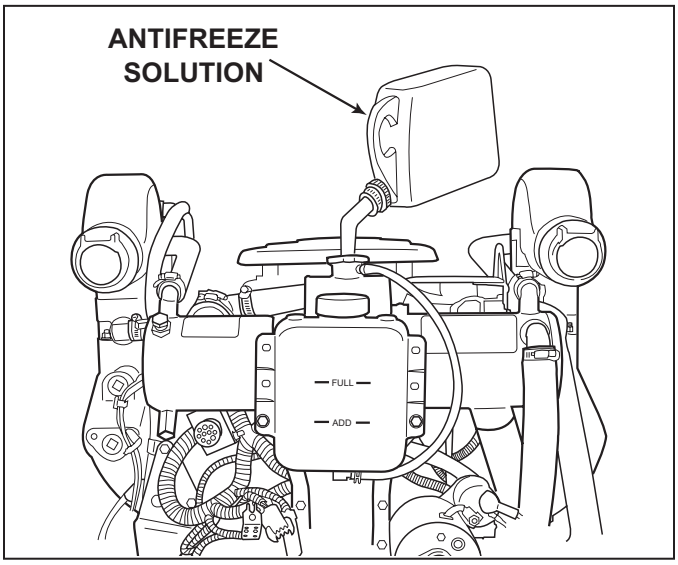


Figure 11-12 Filling F.W.C. System

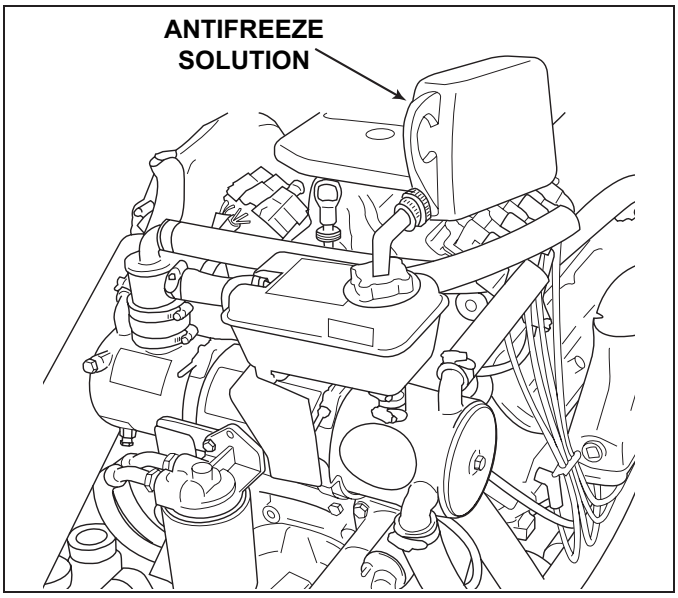


Figure 11-13 Filling F.W.C. System (6.0L) (Typical)

CLEANING SEA-WATER SECTION OF HEAT EXCHANGER - FRESH-WATER COOLED MODELS ONLY

The sea-water section of the heat exchanger should be cleaned whenever there is a noticeable decrease in cooling efficiency. You may use the following procedure for cleaning, or, if the build-up of scale and mineral deposits is heavy, it is recommended that the heat exchanger be removed and taken to a repair facility to be boiled out (such as a radiator repair facility).

1. Remove the bolts securing the heat exchanger end plates. Remove the end plates and gaskets.

2. Clean the water passages in the heat exchanger by inserting a suitable-size wire brush into each passage. Use compressed air to blow out loose particles.

3. Clean the gasket surfaces on the end plates and the heat exchanger. Apply PerfectSeal to both sides of the new gaskets. Install the end plates and the new gaskets onto the heat exchanger. Install the bolts and tighten securely.

4. Start the engine and inspect for leaks.

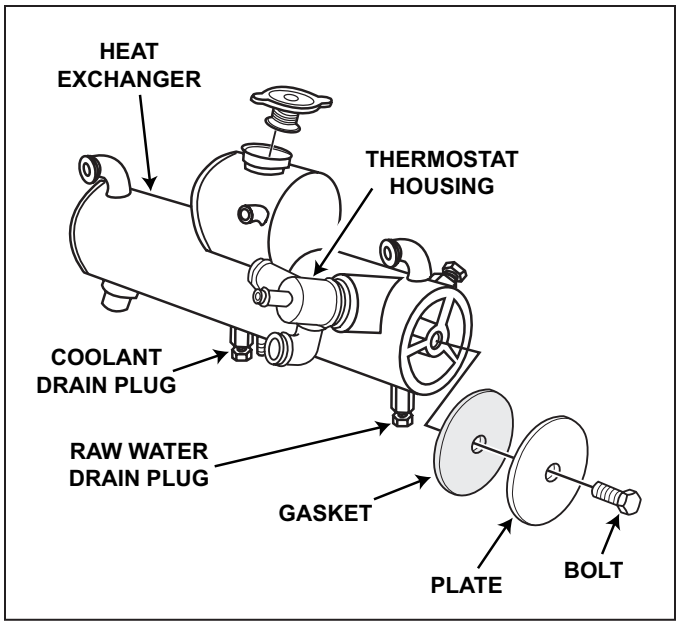


Figure 11-14 Heat Exchanger and End Plate Removal (Typical)

FUEL SYSTEM DESCRIPTION

WARNING

Extreme caution must be exercised when servicing the fuel system and/or replacing fuel filter. Gasoline is extremely flammable and highly explosive under certain conditions. Be sure the ignition key is off and do not smoke or allow open flame in the area while servicing. Wipe up any spilled fuel immediately.

WARNING

Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

WARNING

Make sure that there are no fuel leaks before closing the engine hatch.

WARNING

Visually inspect unit for fuel leaks before operating the engine. If fuel leaks are present, DO NOT operate the engine, contact your service center immediately.

Crusader Marine Engines will be equipped with one of two fuel systems: the Fuel Control Cell (FCC), or the "Returnless-Type."

The "Return-Type" fuel system is best described as having a fuel feed line coming from the fuel tank and fuel line that returns unused fuel back to the fuel tank.

The "Returnless-Type" fuel system requires a fuel feed line to supply fuel. Unused fuel is circulated through a cooler and is eventually returned to the fuel feed line.

Fuel Control Cell (FCC) Fuel System

The Fuel Control Cell (FCC) eliminates vapor lock and air ingestion caused by fuel tank slosh, and provides the necessary filtration and water separation.

The FCC system incorporates two (2) fuel pumps to provide an uninterrupted flow of fuel to your Crusader marine engine. Fuel is fed into the FCC bowl by a low-pressure, high-volume electric fuel pump. This pump flows fuel at a volume much greater than the fuel flow rate required of the high-pressure pump and engine demands. The high-pressure pump, mounted inside the FCC bowl, provides the necessary fuel pressure and volume to maintain proper engine performance. The FCC constantly has an ample supply of fuel to meet the idle, cruise and acceleration fuel requirements of the engine.

The fuel pressure regulator, located on the fuel rail, controls the fuel pressure, and maintains a constant pressure across the fuel delivery system. 6.0L engines' fuel pressure regulator is located inside the FCC, therefore, does not require a fuel return line from the fuel rail. Excess fuel, not used by the engine, returns to the FCC bowl.

The fuel delivered to the engine by the FCC is filtered by a filter and water separator element, which surrounds the high pressure pump inside the FCC bowl.

As indicated above, fuel enters the FCC bowl from two (2) locations, the low-pressure pump (initial input) and the fuel pressure regulator (unused, recirculating fuel). Fuel exits the FCC bowl at two (2) locations, the high-pressure output to the fuel injection system and all excess fuel in the FCC bowl is routed back to the tank via the return line.

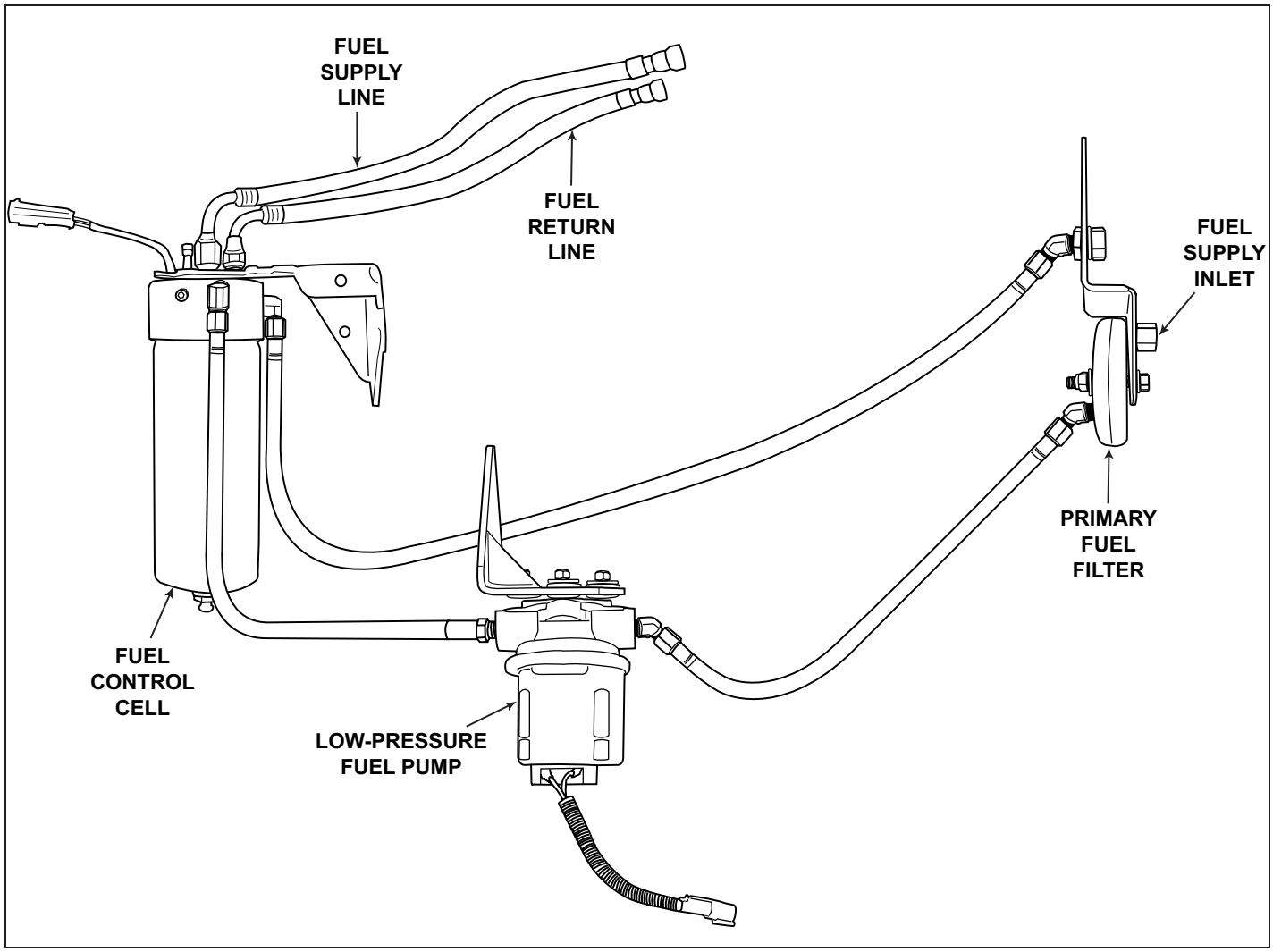


Figure 11-15 Fuel Control Cell (FCC) Fuel System (Typical)

Servicing the FCC

The frequency of draining the water or replacing the filter element is determined by the contamination level of the fuel. Replace the filter element at least once a year, or when a loss of power is noticed (whichever occurs first).

WARNING

Improper use, installation or servicing may cause an explosion or fire resulting in bodily injury, or death. This unit should only be serviced by a qualified technician. Read and follow all instructions before proceeding. Run the engine and check for fuel leaks after installation, element replacement or draining the bowl. DO NOT remove the FCC bowl unless servicing the filter element, otherwise contamination or bowl O-ring swelling may result.

WARNING

Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

Draining the FCC Bowl, ENGINE OFF

1. Disconnect the two-wire electrical connector.
2. Hold the 3/4" jam nut, located at the bottom of the FCC bowl, with a wrench. Remove the 7/16" plug, and drain the bowl contents into an approved container.

CAUTION: Both fuel and water will drain from the FCC bowl.

3. Apply pipe sealant, suitable for use with gasoline, to the threads of the 7/16" plug.
4. Tighten the 7/16" plug while holding the 3/4" jam nut with a wrench.
5. Reconnect the two-wire electrical connector.
6. Cycle the ignition key several times to run the electric fuel pumps and fill the FCC bowl with fuel. Inspect the drain plug area for leaks. Correct any leaks prior to operating the engine.
7. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

Filter Element Replacement, ENGINE OFF

1. Disconnect the two-wire electrical connector.
2. Hold the 3/4" jam nut, located at the bottom of the FCC bowl, with a wrench. Remove the 7/16" plug, and drain the bowl contents into an approved container.

CAUTION: Both fuel and water will drain from the FCC bowl.

3. Using a strap-type oil filter wrench, remove the FCC bowl by turning it counterclockwise as view from the bottom.
4. Slide the bowl downward over the suspended filter element. It may be necessary to pull the unit to one side in order to remove the FCC bowl.
5. Remove the fuel filter element from the suspended pump by gripping the fuel pump with one hand, and pulling the filter element downward with the other hand.
6. Push on new filter element (part number RP080026) over the electric fuel pump.

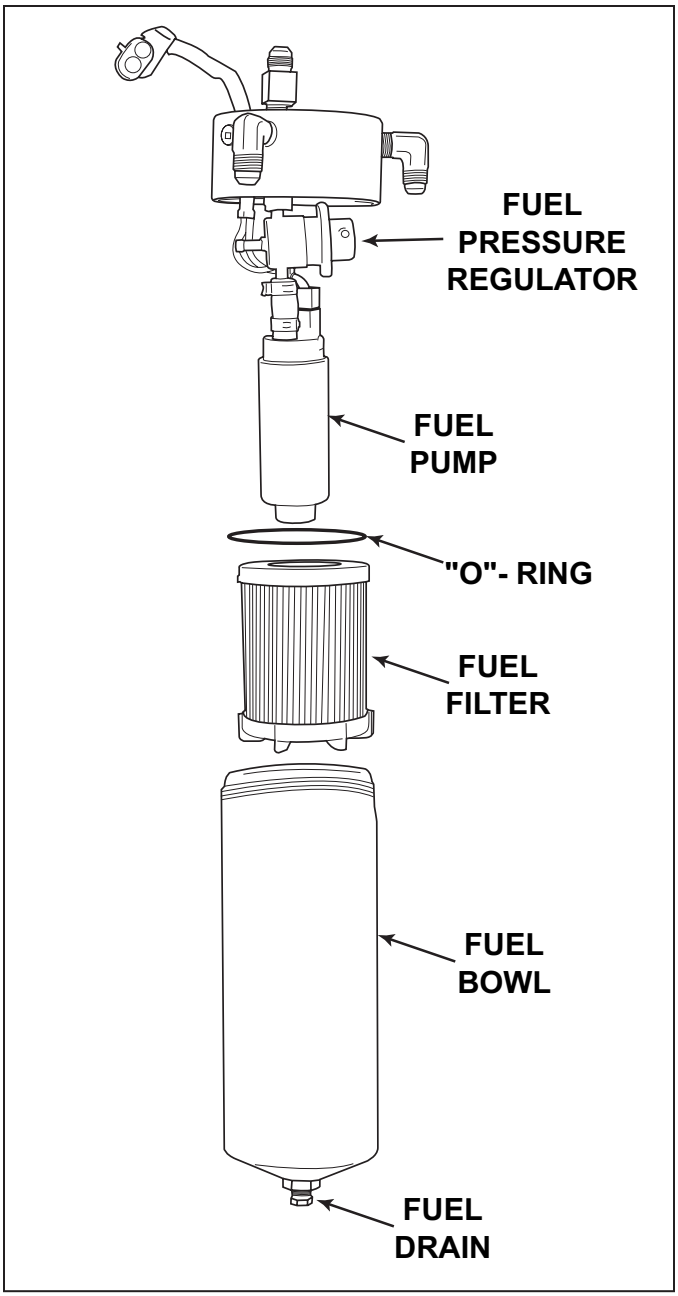


Figure 11-16 Fuel Control Cell (FCC) (6.0L)

7. Using a pick made of soft material, such as a toothpick, remove the old O-ring from the inside of the FCC bowl mounting head.

CAUTION: The mounting head O-ring groove may be damaged by using sharp steel tools to remove this O-ring.

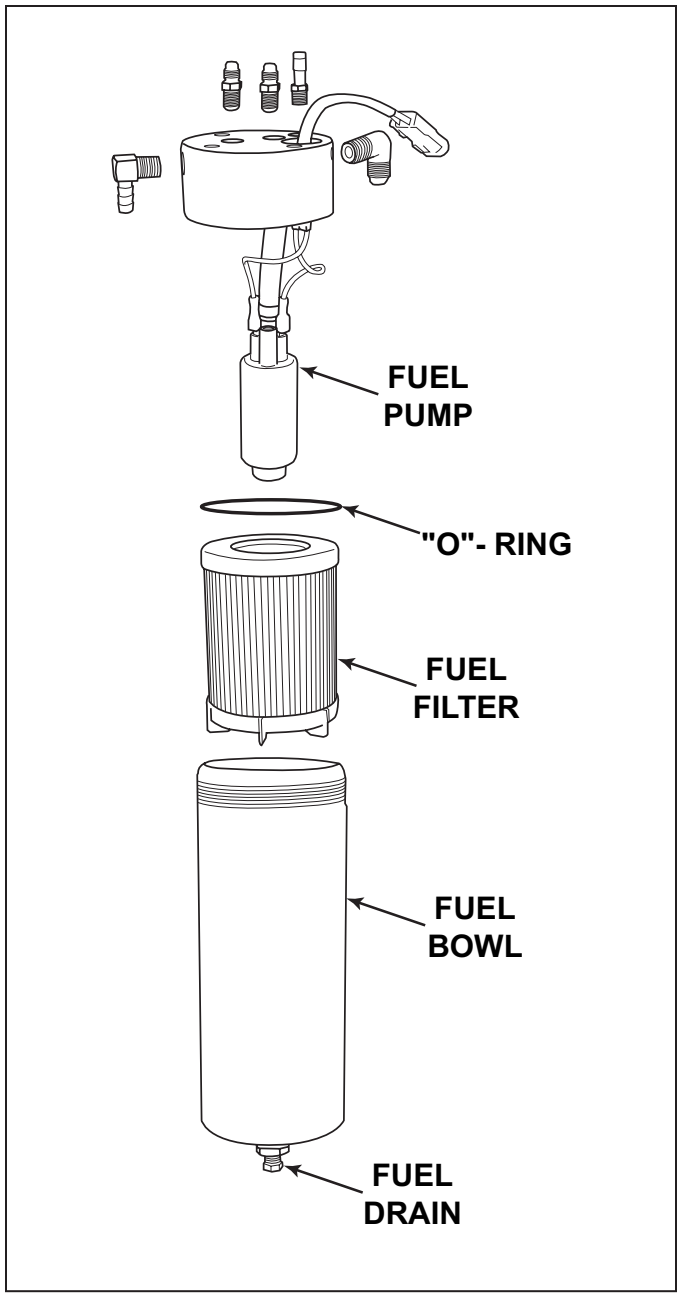


Figure 11-17 Fuel Control Cell (FCC) (Typical)

8. Lubricate the new O-ring with a light grease and install the new O-ring into the FCC bowl mounting head.
9. Apply pipe sealant, suitable for use with gasoline, to the threads of the 7/16” plug.
10. Install and tighten the 7/16” plug while holding the 3/4” jam nut with a wrench.
11. Grease taper and the threads on the FCC bowl and, by hand, thread the FCC bowl into the FCC mounting head. Tighten the bowl firmly back into the mounting head with an oil filter wrench.
12. Reconnect the two-wire electrical connector.
13. Cycle the ignition key several times to run the electric fuel pumps and fill the FCC bowl with fuel. Inspect the drain plug area for leaks. Correct any leaks prior to operating the engine.
14. Start the engine and inspect for fuel leaks. Correct any leaks prior to operating the engine any further.

DO NOT ATTEMPT TO SERVICE ANY OTHER PARTS ON THIS UNIT.

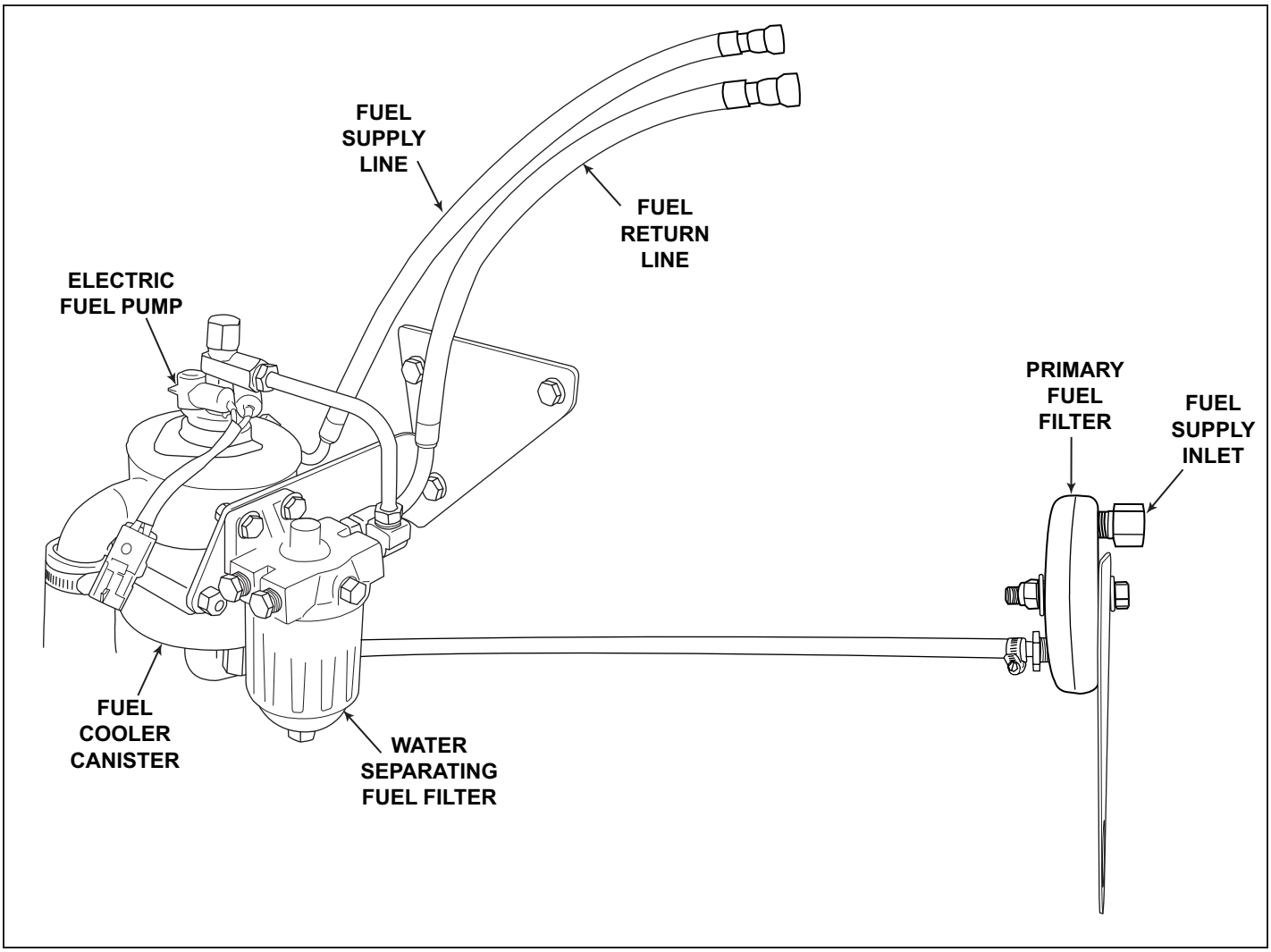


Figure 11-18 Returnless-Type Fuel System (Typical)

Primary Fuel Filter

⚠ WARNING
Extreme caution must be exercised when servicing the fuel system. The fuel system operates under high pressure. Use caution when removing or replacing components, as residual pressure may be present.

Dependent upon application, the primary fuel filter may be located at the front of the engine, rear of the engine on the transmission housing or next to the electric fuel pump. This filter filters the fuel before it reaches the fuel pump.

1. Close the fuel supply line (shut-off valve). Start the engine and let it run until it stalls from lack of fuel.

2. Turn ignition key OFF.

NOTICE: A rag should be placed under the filter to absorb any spilled fuel. Remove the bracket from the block for servicing.

3. Remove the nut and washer that secures both halves of the filter housing. Separate the housing.

4. Remove the filter/seal assembly. Clean with soap and water.

5. Inspect the filter screen and rubber seal for any signs of damage. Replace as necessary.

6. Reinstall filter/seal assembly into the housing halves. Make sure the seals are aligned properly. Install the nut and washer.

7. Open fuel shut-off valve.

8. Prime the fuel system. Refer to procedures in this section.

9. Turn the key to START position and crank the engine until it starts, or 30 seconds elapse.

10. Repeat step 8 if the engine fails to start.

11. After the engine starts, check for leaks and repair as necessary.

⚠	**WARNING**
Make sure there are no fuel leaks before closing the engine hatch.	

Priming Fuel System

To prime the fuel system, cycle the ignition key 3 times using the following procedures:

1. Turn ignition key to ON position for 5 seconds.

2. Turn ignition key OFF.

3. Pause for 10 seconds.

4. Repeat steps 1-3 three times.

Crank the engine until it starts or 30 seconds elapse. If the engine does not start, repeat the priming procedures.

FLAME ARRESTOR

At specified intervals, the flame arrestor should be checked for blockage caused by dirt or other foreign material.

Loosen the clamp securing the flame arrestor to the air intake tube or throttle body. Remove the flame arrestor. Clean the flame arrestor with solvent and dry with compressed air. Reinstall the flame arrestor and tighten the clamp(s) securely.

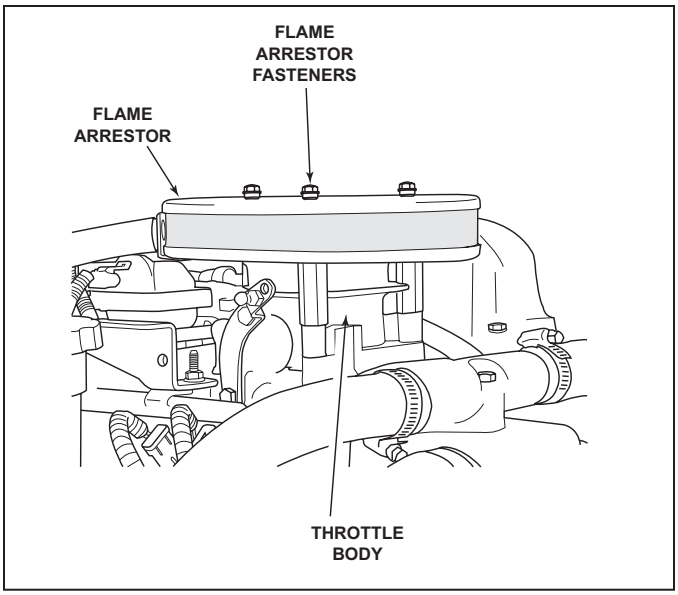


Figure 11-19 Flame Arrestor - 5.7L (Typical)

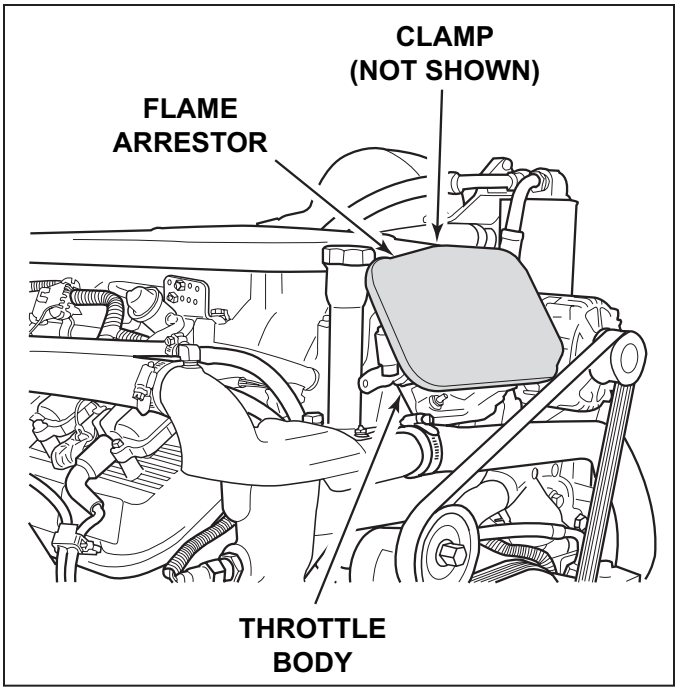


Figure 11-20 Flame Arrestor - 8.1L (Typical)

DRIVE BELT INSPECTION

Inspect the drive belt for excessive wear, shredding or missing sections.

Inspect the drive belt for contamination from excessive dirt, oil, coolant or other substances that may effect the drive belt operation.

If a problem is found, replace the belt after inspecting the following items:

- The engine water circulation pump and alternator pulleys for signs of misalignment
- The engine water circulation pump and alternator pulleys for signs of rust or other damage
- Bent pulleys or tight bearings in the engine water circulation pump and alternator

8.1L ACCESSORY DRIVE BELT

The Crusader 8.1L engine uses a single serpentine belt to drive the engine water circulation pump and the alternator. The sea-water pump is mounted onto the crankshaft pulley and is driven directly by the crankshaft.

CAUTION

The replacement of the drive belt requires the removal of the inlet hose from the sea-water pump. With the hose removed, it is possible for water to enter the bilge of the boat, and possibly sink it. ALWAYS plug the inlet hose securely to prevent this possibility from occurring.

DRIVE BELT REPLACEMENT

1. Remove the inlet and outlet hoses from the sea-water pump, being careful not to allow the hose clamps to fall into the bilge.
2. Remove the bolt and washers that attach the sea-water pump to the bracket, being careful not to allow the bolt and washers to fall into the bilge.
3. Loosen the bolts that attach the bracket to the engine block until a gap, large enough to pass the belt through, is created.
4. Note the routing of the belt before removing.

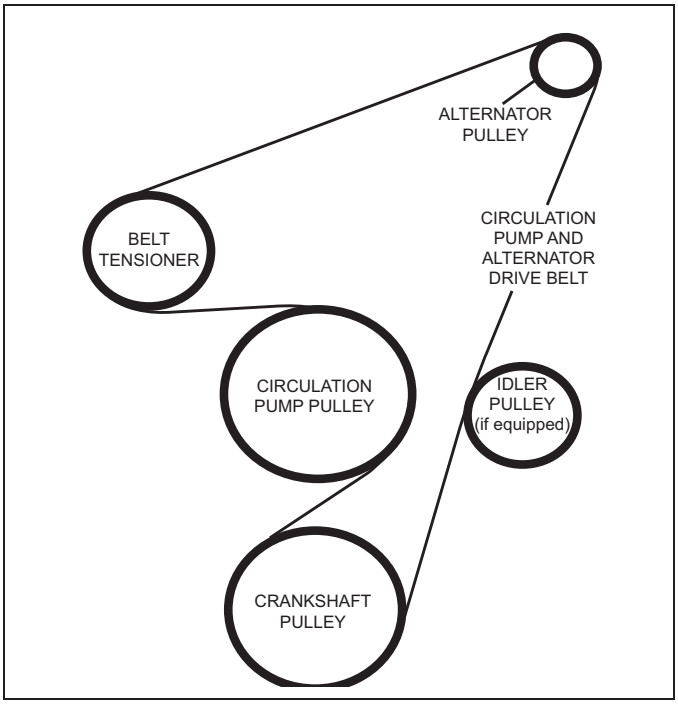


Figure 11-21 8.1L Accessory Drive Belt Configuration

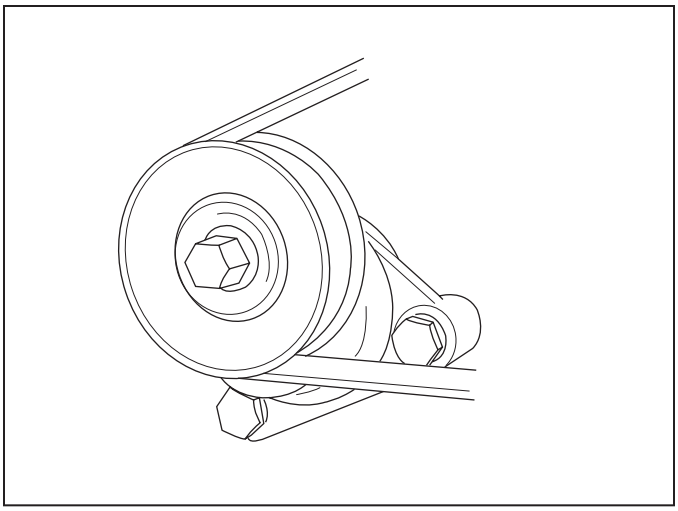


Figure 11-22 Belt Tensioner (8.1L)

5. Using a 15 mm box wrench or socket, turn the belt tensioner to relieve the tension on the belt. Slide the belt off of the pulleys and through the gap between the sea-water pump and the bracket. ***Release the tensioner slowly to prevent the tensioner from snapping against its stop, and possibly causing damage to the tensioner.***

5. Slide the new belt through the gap between the sea-water pump and the bracket. Slide the belt onto the pulleys using the same routing as noted prior to removal.

6. Compress the belt tensioner, and slide the belt over the tensioner pulley. Release the tension slowly to tension the belt.

7. Position the bracket onto the sea-water pump anchor boss, and install the flat washer, lock washer and bolt to the pump.

8. Tighten the bracket-to-engine block attaching bolts to 18 lb. ft.

9. Tighten the bolt that secures the sea-water pump to the bracket to 12 lb. ft.

10. Install the inlet and outlet hoses to the sea-water pump. Position the hoses and clamps so that the clamps are clamping on the pump side of the fitting bead. Tighten the clamps securely.

6.0L ACCESSORY DRIVE BELT

The Crusader 6.0L engine uses a single serpentine belt to drive the engine water circulation pump, sea-water pump and the alternator.

DRIVE BELT REPLACEMENT (6.0L)

1. Note the routing of the belt before removing.

2. Using a 15 mm box wrench or socket, turn the belt tensioner to relieve the tension on the belt. Slide the belt off of the pulleys. ***Release the tensioner slowly to prevent the tensioner from snapping against its stop, and possibly causing damage to the tensioner.***

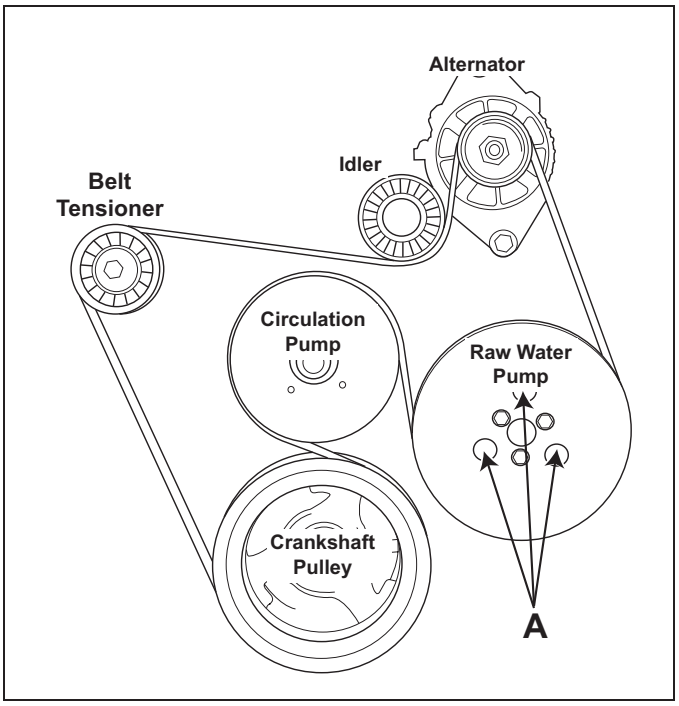


Figure 11-23 6.0L Accessory Drive Belt Configuration

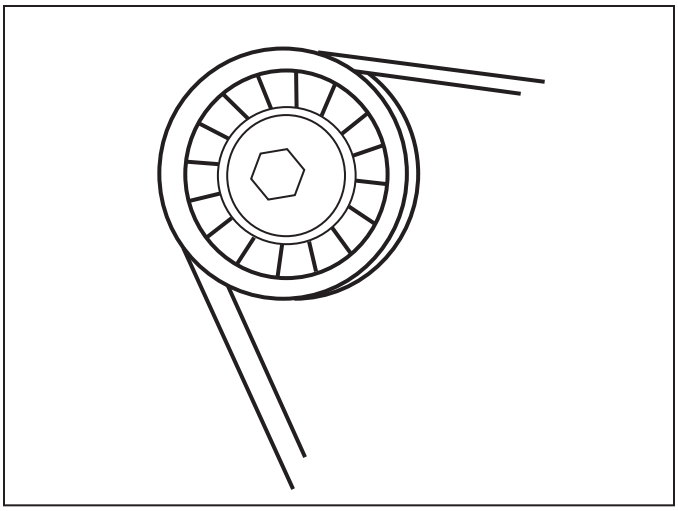


Figure 11-24 Belt Tensioner (6.0L)

3. Slide the new belt onto the pulleys using the same routing as noted prior to removal.

4. Compress the belt tensioner, and slide the belt over the tensioner pulley. Release the tension slowly to tension the belt.

SERVICING RAW WATER PUMP IMPELLER (6.0L)

The raw water pump impeller should be serviced every 50 hours, or once a year, whichever occurs first. See Maintenance Schedule.

Locations “A” (Figure 11-23) are access holes in order to loosen the raw water pump attaching bolts. The bolts are secured in the pump by O-rings, and will not fall out during removal.

WARNING

Engine must be shut OFF and the ignition key removed before inspecting the drive belt(s). The drive belt(s) should be checked periodically for condition and tension. If the belt(s) shows signs of cracking, glazing or deterioration, replace with new belt(s).

ACCESSORY DRIVE "V"- BELT (5.7L ENGINE)

Check the drive belt tension by pressing down on the belt midway between the engine circulating pump pulley and the alternator pulley. The belt should depress 1/2 in. (13 mm). If depression is more than allowable, adjust the tension by loosening the alternator adjustment bolt and the pivot bolt. Apply required pressure with a pry bar to tighten the belt tension. While maintaining pressure, tighten the alternator adjusting bolt securely. Tighten the pivot bolt.

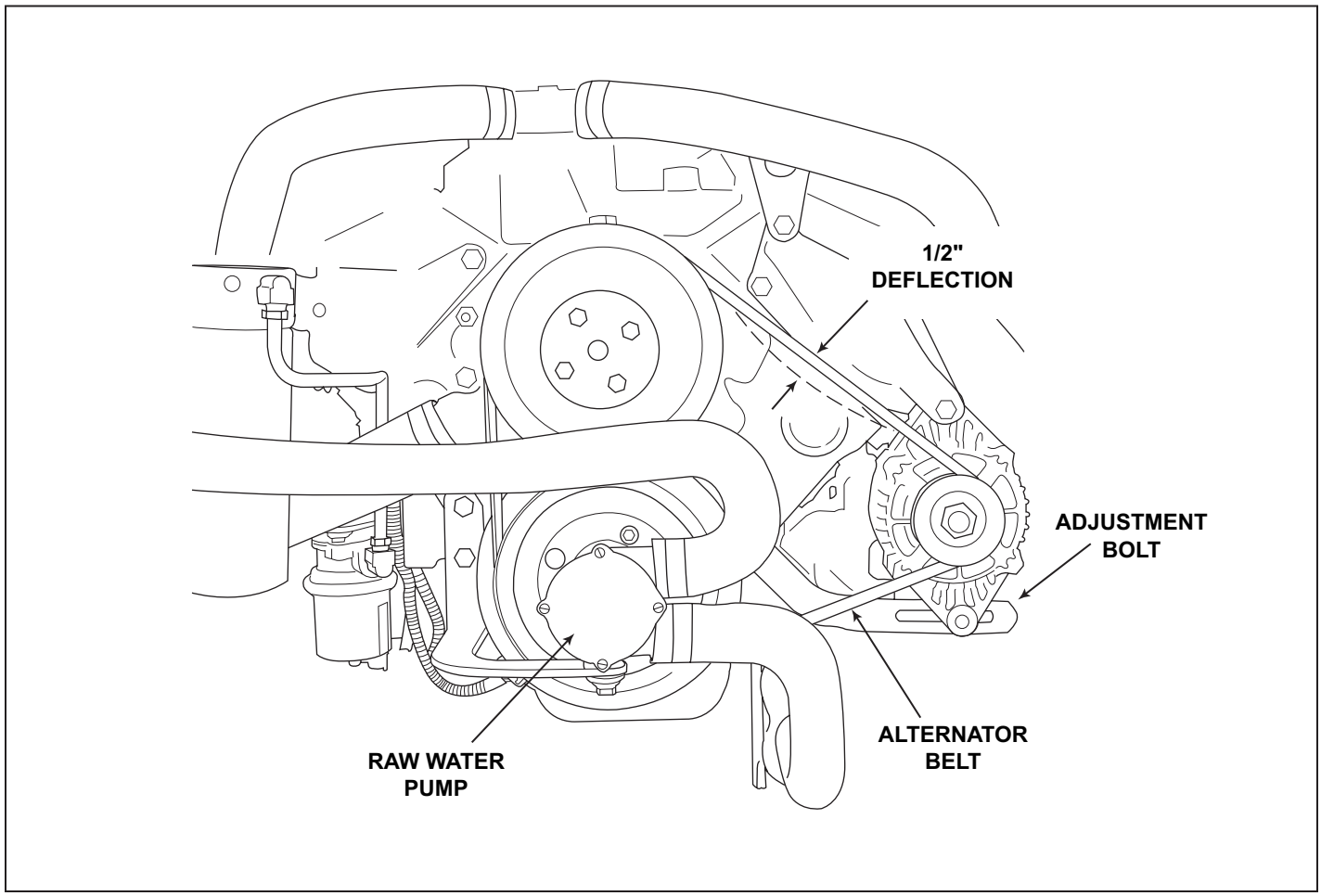


Figure 11-25 Drive Belt Location and Adjustment (5.7L)

CHANGING OILS

WARNING

IMPORTANT: The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters and continuous zone of the United States, if such discharge causes a film or sheen upon, or discoloration of the surface of the water, or causes sludge or emulsion beneath the surface of the water. Violators are subject to a penalty of $5,000.00.

Refer to the MAINTENANCE SCHEDULE for oil change intervals. The engine and transmission oils should be changed prior to placing the boat into storage.

The transmission oil change should be performed by an authorized dealer, at specified intervals.

IMPORTANT: Change the engine oil when the engine is warm from operation. Warm oil flows more freely, and allows more foreign material and impurities to be removed.

The engine oil filter is remote mounted. The engine block location, where the filter is normally mounted, is covered with an oil filter bypass adapter. DO NOT remove this adapter when changing the oil.

1. With the engine at normal operating temperature, remove the dipstick and install a crankcase oil pump onto the dipstick tube (Figure 11-25). Insert the discharge hose into a suitable container. Pump the oil from the engine until the crankcase is empty. Remove the oil pump from the dipstick tube.

2. Remove the oil filter by turning it counterclockwise, using an oil filter wrench if necessary. Discard the old filter and sealing ring.

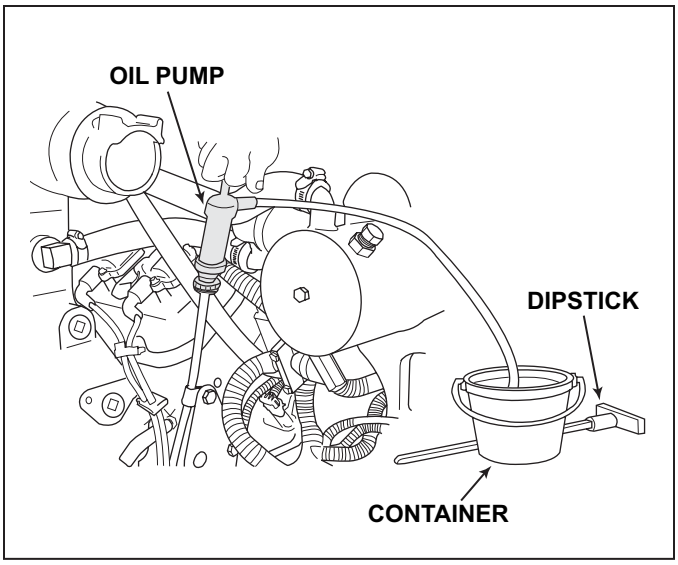


Figure 11-25 Engine Oil Removal

3. Coat the sealing ring, on the new filter, with a light coating of clean engine oil. Install the oil filter securely by hand. DO NOT overtighten.

4. Fill the engine with the recommended oil, see OIL REQUIREMENTS, through the oil fill location on the valve cover (Figure 11-26).

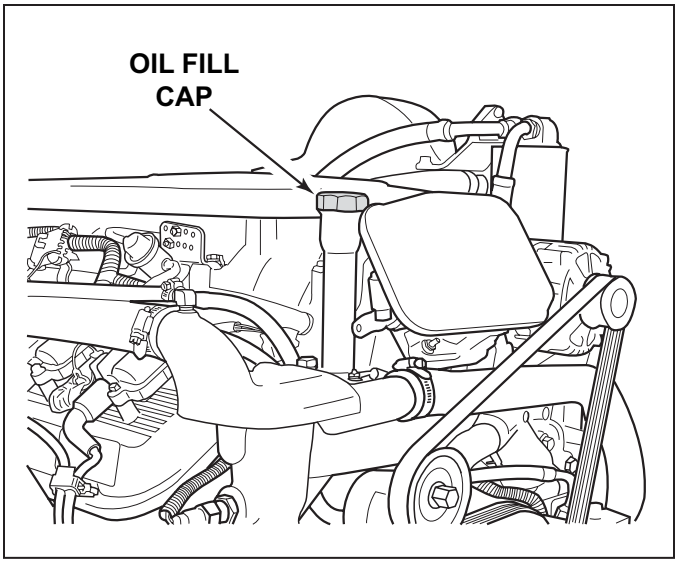


Figure 11-26 Engine Oil Fill (8.1L)

5. Start the engine and operate for 5 minutes to circulate the oil throughout the engine. Check entire system for leaks, especially around the oil filter.

6. Stop the engine and wait 5 minutes to allow the oil to completely drain down. Check the oil level and add oil, if needed, to bring the engine oil to the proper level.

ENGINE ALIGNMENT

CAUTION

Engine must be properly aligned, or vibration, noise and damage to the transmission output shaft oil seal and bearings may result.

IMPORTANT: Engine alignment MUST BE RECHECKED with the boat in the water, fuel tanks full and with a normal load on the boat. Engine must be aligned so that the transmission and the propeller shaft coupling center lines are aligned, and coupling faces are parallel within 0.003 in. (0.07 mm). This applies to installations with solid couplings, as well as flexible couplings.

1. Check the mating surfaces on the transmission and the propeller shaft couplings. Make sure they are clean and flat.

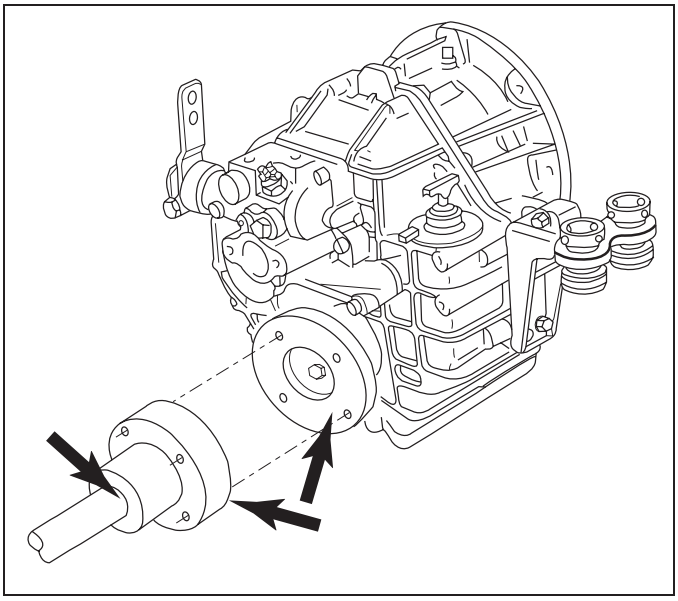


Figure 11-27 Shaft Mating Surface Check - 8 Degree Down Angle

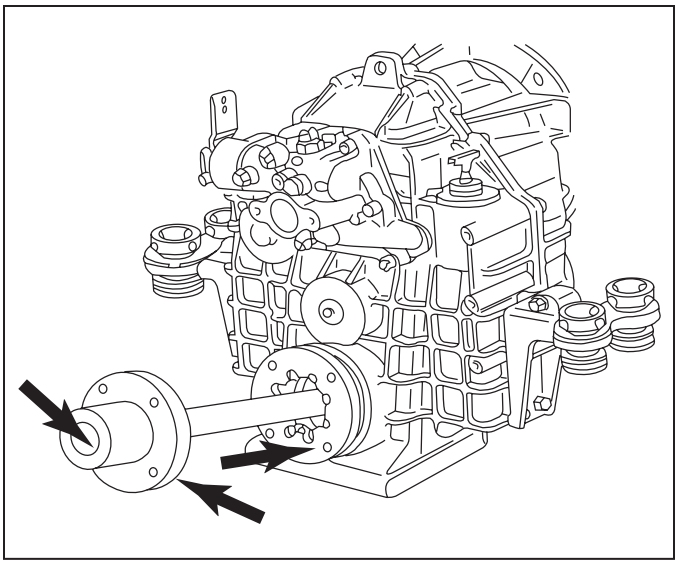


Figure 11-28 Shaft Mating Surface Check - "V" Drives

2. Center the propeller shaft in the shaft log as follows:
   - Push down and then lift the propeller shaft as far as it will move, then place the shaft in the middle of the movement.
   - Move the shaft to the port and then to the starboard as far as the shaft will move, then place the shaft in the middle of the movement.
   - With the propeller shaft in the middle of the shaft log, align the engine to the shaft.
3. Check that the coupling center lines align by butting the propeller shaft coupling against the transmission coupling. The shoulder on the propeller shaft coupling face should engage recessed on the transmission coupling face, with no resistance.

NOTICE: Some propeller shaft couplings may not have a shoulder on the mating surface. On these installations, use a straight edge to check the centerline alignment.

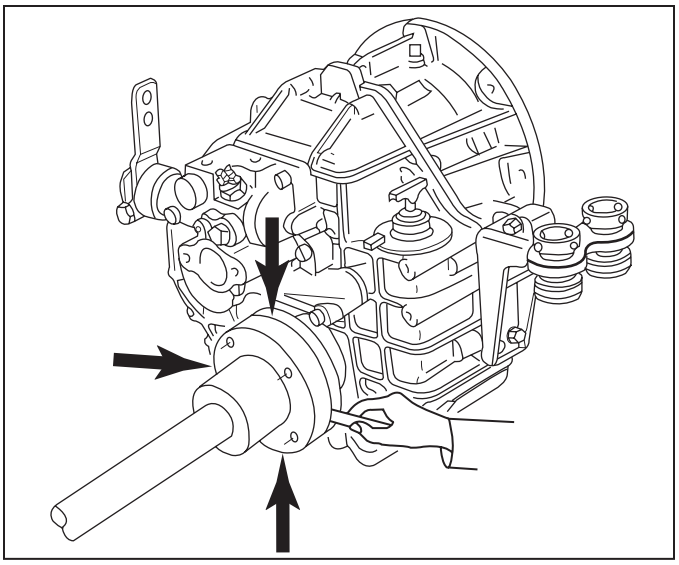


Figure 11-29 Centering Propeller Shaft - 8 Degree Down Angle

4. Check for any angular misalignment. Hold coupling faces tightly together and check for a gap between the coupling faces, with a 0.003 in. (0.07 mm) feeler gauge, at 90-degree intervals.

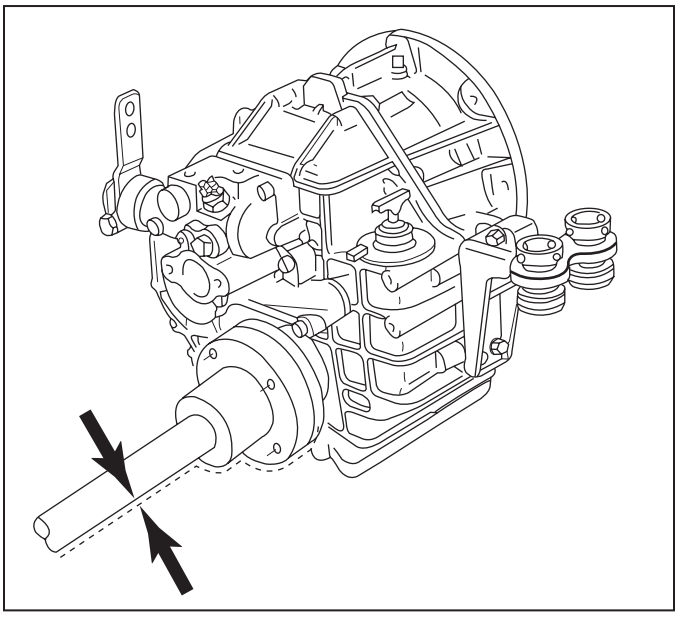


Figure 11-30 Angular Alignment - 8 Degree Down Angle

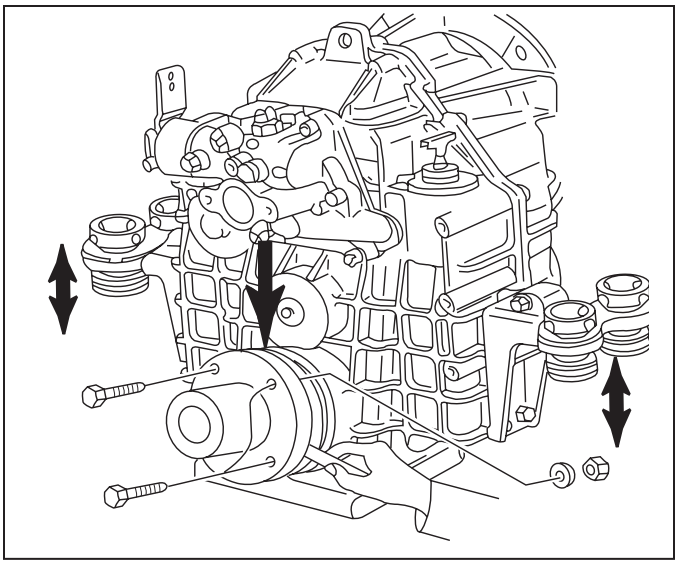


Figure 11-31 Angular Alignment - "V" Drives

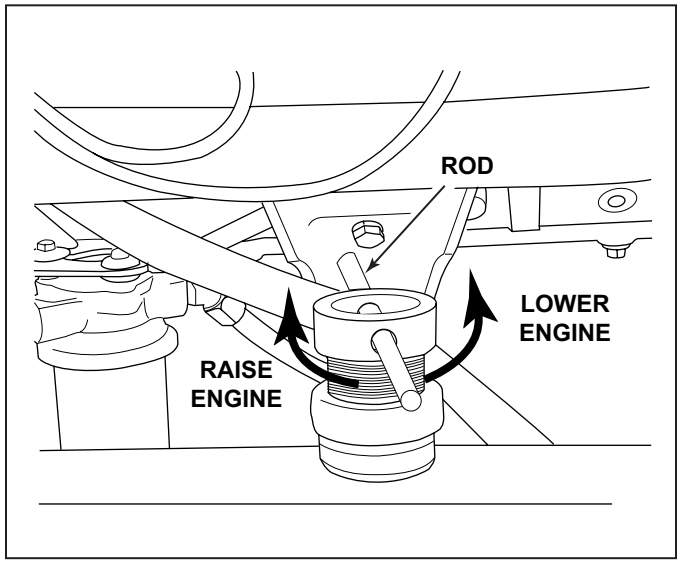


Figure 11-32 Engine Mount Adjustment

5. If the coupling center lines are not aligned, or if the coupling faces are more than 0.003 in. (0.07 mm) out of parallel, adjust the engine mounts as follows:

   - UP or DOWN ADJUSTMENT: Loosen the lag bolt 1/4 turn. Use the mount adjusting tool or a 3/8 in. (0.95 cm) or 1/2 (1.27 cm) diameter rod through both sides of the adjusting sleeve to turn. Turn the adjusting sleeve in the direction required to raise or lower the engine. After the adjustment is complete, tighten the lag bolt.

IMPORTANT: Both the front mount (or rear mount) adjusting sleeves must be turned equally to keep the engine level from side to side.

   - LEFT or RIGHT ADJUSTMENT: Loosen the trunnion clamping bolt and the nut on all four mounting brackets. Move the engine to the left or right, as necessary, to obtain the proper alignment.

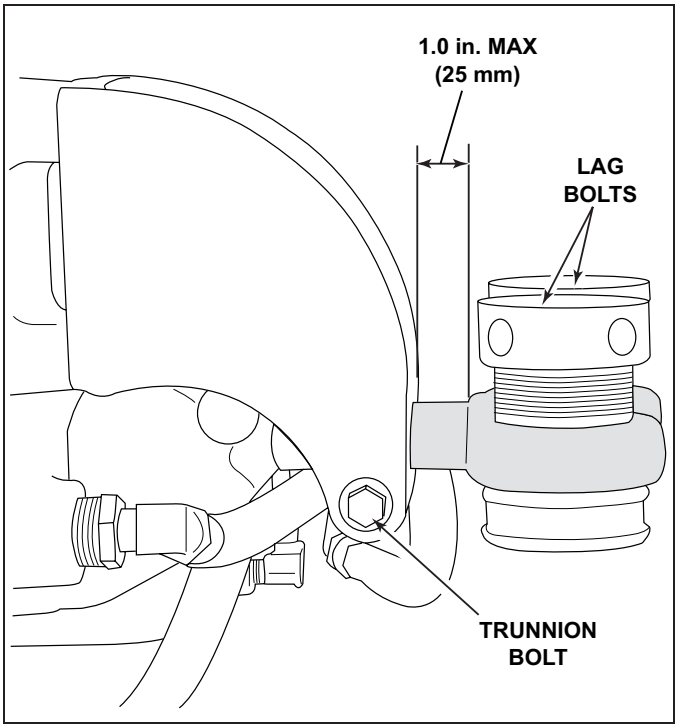


Figure 11-33 Engine Extension

IMPORTANT: The large diameter of the mount trunnion MUST NOT extend over 1.0 in. (25.4 mm) from the mounting brackets on any of the mounts.

6. After the engine has been properly aligned, secure the engine mounts.

7. Connect the propeller shaft coupling to the transmission coupling. Tighten the coupling attaching bolts and nuts to the correct specifications.

FASTENER TORQUE SPECIFICATIONS

Location	Lb-Ft (N·m)
Engine Mount to Stringer	Securely
Propeller	50 (68)
Trunnion Bolts	45 (61)

ENGINE MAINTENANCE - 11

Date	ENGINE MAINTENANCE LOG Maintenance/Repair	Operating Hours

MAINTENANCE SCHEDULE

Location and Service	Check Daily	After 1st 25 Hrs of Operation	Every 50 Hours of Operation	Every 100 Hours of Operation	Once Each Year
Check coolant level - Fresh-water cooled models only	X				
Check oil level - Engine crankcase	X				
Check oil level - Transmission	X				
Engine Assembly (complete - Check for obvious leaks (water, oil, fuel and exhaust)	X				
Remote Control and Steering System - Check for proper operation	X				
Sea Strainer - Check (if equipped)	X				
Cooling System - Check condition and tightness of all hose clamps		X		X[1]	X
Cooling System - Replace raw water pump impeller			X		X
Drive Belt - Inspect condition and check tension		X		X	X
Exhaust System - Check condition and tightness of all hose clamps		X		X[1]	X
Exhaust System - Check for water leaks at the manifold, riser and elbow gaskets	X				
Ignition System and Spark Plugs - Clean and inspect condition		O		O	O
Engine Assembly (complete) - Check for loose, missing or damaged parts (especially engine mounts, starter and alternator mounting fasteners)		X		X	X
Change engine oil and filter		X	X		X
Engine Alignment - Check and adjust if necessary		O			O
Ignition Timing - Not Adjustable					
Battery - Check electrolyte level and specific gravity. Inspect case for damage. Check cables and connections.		X	X		X
Electrical System (complete) - Check for loose or dirty connections and damaged wiring			X[2]		X
Flame Arrestor and Crankcase Ventilation System - Clean and inspect				X	X

MAINTENANCE SCHEDULE (cont'd)

Location and Service	Check Daily	After 1st 25 Hrs of Operation	Every 50 Hours of Operation	Every 100 Hours of Operation	Once Each Year
Hoses (all) - Inspect for cracks, swelling, weather checking or other signs of deterioration				X	X
Shift and Throttle Cable Linkage - Inspect and lubricate (A)				X[1]	X
Fuel Filters - Service or replace		O			O
Transmission and "V" Drive - Change fluid (B,C) and clean strainer, if equipped		O Hurth Only			O

MAINTENANCE SCHEDULE (cont'd)

Fresh-water cooled models - Clean sea-water section	As required [3] (X)
Fresh-water cooled models - Check coolant for boil/freeze protection	At least once each year (X)
Fresh-water cooled models - Change coolant	Every five years
Zinc Anodes - Heat exchanger and cooler - check condition	Every 30 days [3] (X)
Engine Assembly Exterior Surfaces - spray with rust-preventative oil (D)	Fresh water areas - Every 60 days (X) Salt water areas - Every 30 days (X)
Cooling System (SALT WATER AREAS ONLY) - Flush sea-water section	After use each day (X)

Notes:

(X) Denotes service to be performed by the owner/ operator

(O) Denotes service to be performed by an authorized Crusader Marine Engines dealer

(A) Use SAE 30 engine oil

(B) All Velvet Drive and Hurth transmissions - Use Dexron III automatic transmission fluid

(C) All Velvet "V" Drive transmissions - Use Dexron III automatic transmission fluid

All Walters "V" Drive transmissions - Use Exxon Spartan EP-68 or SAE 30 engine oil

All Crusader "V" Drive transmissions - Use SAE 80W-90 gear oil

(D) Use WD-40 penetration oil or equivalent

[1] In fresh-water areas, every 100 hours of operation or 120 days (whichever occurs first). In salt-water areas, every 50 hours of operation or 60 days (whichever occurs first).

[2] In fresh-water areas, every 50 hours of operation or 60 days (whichever occurs first). In salt-water areas, every 25 hours of operation or 30 days (whichever occurs first).

[3] Requires more frequent inspection if used in extremely salty, polluted or mineral-laden waters.

VISUAL INSPECTION

It is important for the owner/operator to visually inspect the complete engine assembly at regular intervals. Most often, costly repairs can be avoided if potential problems are corrected before there is a failure.

Inspect the complete engine assembly for obvious fuel, oil, water or exhaust leaks. Check for loose, damaged or missing parts. Check all hose clamps for adequate tightness. Check the electrical system for loose or dirty connections or damaged wiring.

Touch up scratches, nicks and corrosion damage to the exterior finish of the engine. Spray paint may be obtained from your local Crusader Marine Engines dealer.

Protect engine finish from corrosion by periodically spraying the engine exterior finish with a rust preventative oil (such as WD-40).

ENGINE FLUID CAPACITIES

Model	MP 5.0L / 5.7L	MP 6.0L	MP 8.1L
Crankcase Oil Capacity W / New Filter Aluminum Pan Stamped Steel Pan	6 Quarts (5.67 L)[1] 4 Quarts (3.8 L)[1]	5 Quarts (4.75 L)[1] N/A	7 Quarts (6.65 L)[1] N/A
Fresh Water Cooling System Capacity	23 Quarts (21.85 L)	23 Quarts (21.85 L)	33 Quarts (31.35 L)

TRANSMISSION FLUID CAPACITIES

Model	All Models	Type
Velvet Drive, 1:1 Ratio [1,2]	2.5 Quarts (2.37 L)	DEXRON III
Velvet Drive, 1:52 - 2.91:1 Ratio [1,2]	3.5 Quarts (3.31 L)	DEXRON III
Velvet Drive, V-Drive (exc. 5000), All Ratios [1,2]	4.5 Quarts (4.26 L)	DEXRON III
Velvet Drive 5000 (exc. V-Drive), All Ratios [1,2]	3.0 Quarts (2.37 L)	DEXRON III
Velvet Drive 5000 V-Drive, All Ratios [1,2]	4.5 - 5.0 Quarts (4.26 - 4.73 L)	DEXRON III
Hurth (Exc. V-Drive), All Ratios [1,2]	4.0 Quarts (3.79 L)	DEXRON III
Hurth V-Drive, All Ratios [1,2]	4.5 - 5.0 Quarts (4.26 - 4.73 L)	DEXRON III
Walters RV-36D V-Drive	1.5 Quarts (1.42 L)	SAE 30

1 - Capacities are dependent on installation angle. ALWAYS use the dipstick to determine the exact quantity of oil required. Add the correct amount of oil to fill to the “FULL” mark on the oil level dipstick.

2 - Check the transmission fluid level at operating temperature and immediately after shutdown of the engine.

FILTER REQUIREMENTS

Description	Part No.
Oil Filter (remote-mounted)	22679
Primary Fuel Filter Element	47061
Fuel Control Cell (FCC) Fuel Filter Element	RP080026

ON-BOARD PARTS KITS

Description	Part No.
ON-BOARD PARTS KIT 5.7L 2002 TO PRESENT, FCC FUEL SYSTEM	**RK173089A**
Box, On-Board	22433
Belt, V-Belt, Alternator Drive	96307
Rotor, Distributor (HVS)	R103011
Cap, Distributor (HVS)	RA108009
Relay, 12V, Fuel Pump, MEFI	R130012
SparkPlug, Set, (Platinum)	RP030010
Impeller, Raw Water Pump	RP061017
Filter and O-Ring, Kit, FCC	RP080026
ON-BOARD PARTS KIT 5.7L, RETURNLESS FUEL SYSTEM (S/N 630210 TO PRESENT)	**RK173089C**
Box, On-Board	22433
Belt, V-Belt, Alternator Drive	96307
Rotor, Distributor (HVS)	R103011
Cap, Distributor (HVS)	RA108009
Relay, 12V, Fuel Pump, MEFI	R130012
SparkPlug, Set, (Platinum)	RP030010
Impeller, Raw Water Pump	RP061017
Fuel Pre-Filter Screen	R077012
Filter Element, Racor Fuel/Water Separator	47047

ON-BOARD PARTS KITS

Description	Part No.
ON-BOARD PARTS KIT 5.7L, RETURNLESS FUEL SYSTEM (THRU S/N 630209)	**RK173089C**
Box, On-Board	22433
Belt, V-Belt, Alternator Drive	96307
Rotor, Distributor (HVS)	R103011
Cap, Distributor (HVS)	RA108009
Relay, 12V, Fuel Pump, MEFI	R130012
SparkPlug, Set, (Platinum)	RP030010
Impeller Kit, Raw Water Pump	RP061017
Fuel Pre-Filter Screen, 115 Micron	R077013
Filter Element, Racor Fuel/Water Separator	47047
ON-BOARD PARTS KIT 6.0L MPI FCC FUEL SYSTEM	**RK173092**
Box, On-Board	22433
Belt, Serpentine	R066027
Fuse, 20 Amp	R153017B
Relay, 12V, Fuel Pump, MEFI	R130012
SparkPlug, Set, (Platinum)	RP030011
Impeller Kit, Raw Water Pump	RP061022
Fuel Pre-Filter Screen	R077012
Filter and O-Ring, Kit, FCC	RP080026
ON-BOARD PARTS KIT 8.1L FCC FUEL SYSTEM	**RK173087**
Box, On-Board	22433
Belt, Serpentine	R066024
Relay, 12V, Fuel Pump, MEFI	R130012
SparkPlug, Set, (Platinum)	RP030009
Impeller Kit, Raw Water Pump	RP061017
Fuel Pre-Filter Screen	R077013
Filter and O-Ring, Kit, FCC	RP080026

ON-BOARD PARTS KITS

Description	Part No.
ON-BOARD PARTS KIT 8.1L RETURNLESS FUEL SYSTEM	**RK173087A**
Box, On-Board	22433
Belt, Serpentine	R066024
Fuse, 10 Amp	R153017
Fuse, 15 Amp	R153017A
Relay, 12V, Fuel Pump, MEFI	R130012
SparkPlug, Set, (Platinum)	RP030009
Impeller Kit, Raw Water Pump	RP061017
Fuel Pre-Filter Screen	R077013
Filter Element, Racor Fuel/Water Separator	47047

CRUSADER MASTER ENGINE SPECIFICATIONS

MODEL (Horsepower)	MP 5.0L (275 HP)	MP 5.7L (330 HP)	MP 8.1L (STD) (385 HP)	MP 8.1L (HO) (425 HP)	MP 6.0L (375 HP)	Carb 5.7L (300 HP)
Displacement	5.0L (305 CID)	5.7L (350 CID)	8.1L (496 CID)	8.1L (496 CID)	6.0L (366 CID)	5.7L (350 CID)
Bore	3.75 in. (95.0 mm)	4.0 in. (101.6 mm)	4.25 in. (107.95 mm)	4.25 in. (107.95 mm)	4.0007 in. (101.618 mm)	4.0 in. (101.6 mm)
Stroke	3.48 in. (88.3 mm)	3.48 in. (88.3 mm)	4.370 in. (111.0 mm)	4.370 in. (111.0 mm)	3.622 in. (92.0 mm)	3.48 in. (88.3 mm)
Compression Ratio	9.4:1	9.4:1	9.1:1	9.1:1	9.4:1	9.4:1
Compression Pressure	130 - 215 psi	130 - 215 psi	130 - 175 psi	130 - 175 psi	130 - 215 psi	130 - 215 psi
WOT Operating RPM **Preferred WOT RPM**	4600-5000 4800	4800 - 5200 5000	4400 - 4800 4600	4800 - 5200 5000	4800 - 5300 5200	4800 - 5200 5000
Cruising RPM (Max)	3800	4000	3800	4000	4000	4000
Idle RPM (In Gear)	650 (Not Adjustable)	650 (Not Adjustable)	650 (Not Adjustable)	650 (Not Adjustable)	650 (Not Adjustable)	750
Oil Pressure @ 2000 RPM	25 - 60 psi (172 - 414 kPa)	25 - 60 psi (172 - 414 kPa)	25 - 60 psi (172 - 414 kPa)	25 - 60 psi (172 - 414 kPa)	25 - 80 psi (172 - 552 kPa)	25 - 60 psi (172 - 414 kPa)
Minimum Oil Pressure	10 psi (69 kPa) at Idle	10 psi (69 kPa) at Idle	10 psi (69 kPa) at Idle	10 psi (69 kPa) at Idle	10 psi (69 kPa) at Idle	10 psi (69 kPa) at Idle
Spark Plug P/N **Spark Plug Gap**	R030010 0.060 in.	R030010 0.060 in.	R030009 0.060 in.	R030009 0.060 in.	R030011 0.060 in.	R030010 0.060 in.
Firing Order	1-8-4-3-6-5-7-2 (LH) 1-2-7-5-6-3-4-8 (RH)	1-8-4-3-6-5-7-2 (LH) 1-2-7-5-6-3-4-8 (RH)	1-8-7-2-6-5-4-3 (LH) NA	1-8-7-2-6-5-4-3 (LH) NA	1-8-7-2-6-5-4-3 (LH) NA	1-8-4-3-6-5-7-2 (LH) 1-2-7-5-6-3-4-8 (RH)
Thermostat	RWC 160˚F (61.7˚C) FWC 170˚F (76.7˚C)	RWC 160˚F (61.7˚C) FWC 170˚F (76.7˚C)	RWC 160˚F (61.7˚C) FWC 170˚F (76.7˚C)	RWC 160˚F (61.7˚C) FWC 170˚F (76.7˚C)	NA FWC 170˚F (76.7˚C)	RWC 160˚F (61.7˚C) FWC 170˚F (76.7˚C)
Over-Temperature	193° F (89.8° C)	193° F (89.8° C)	220° F (104.8° C)	208° F (98° C)	220° F (104.8° C)	210° F (100° C)
Electrical System	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground	12 Volt Negative (-) Ground
Alternator Rating	70 Amps	70 / 100 Amps	70 / 100 Amps	70 / 100 Amps	70 Amps	70 Amps
Ignition Timing	Not Adjustable	Not Adjustable	Not Adjustable	Not Adjustable	Not Adjustable	26° @ 4000 RPM
CAM Retard	43-47 degrees	43-47 degrees	Not Adjustable	Not Adjustable	Not Adjustable	Not Adjustable
Battery Rating	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah	650 CCA (Minimum) 120 Ah

CRUSADER MASTER FUEL PRESSURE SPECIFICATIONS

MODEL (Horsepower)	MP 5.0L (275 HP)	MP 5.7L (330 HP)	MP 8.1L (STD) (385 HP)	MP 8.1L (HO) (425 HP)	MP 6.0L (375 HP)	Carb 5.7L (300 HP)
Fuel Pressure STD. FCC	57-62 psi @ WOT	57-62 psi @ WOT	44-48 psi @ WOT	44-48 psi @ WOT		
Fuel Pressure RTNLS. TO TANK	57-60 psi @ WOT	57-60 psi @ WOT	43-46 psi @ WOT	43-46 psi @ WOT	57-60 psi @ WOT	
Fuel Pressure - FCC Returnless Rail					59-61 psi (WOT)	
Fuel Pressure LPFP	4-7 psi (WOT)	4-7 psi (WOT)	4-7 psi (WOT)	4-7 psi (WOT)	4-7 psi (WOT)	4-7 psi (WOT)

IMPORTANT: FUEL PRESSURE MEASUREMENT MUST BE MADE WITH THE ENGINE UNDER LOAD.

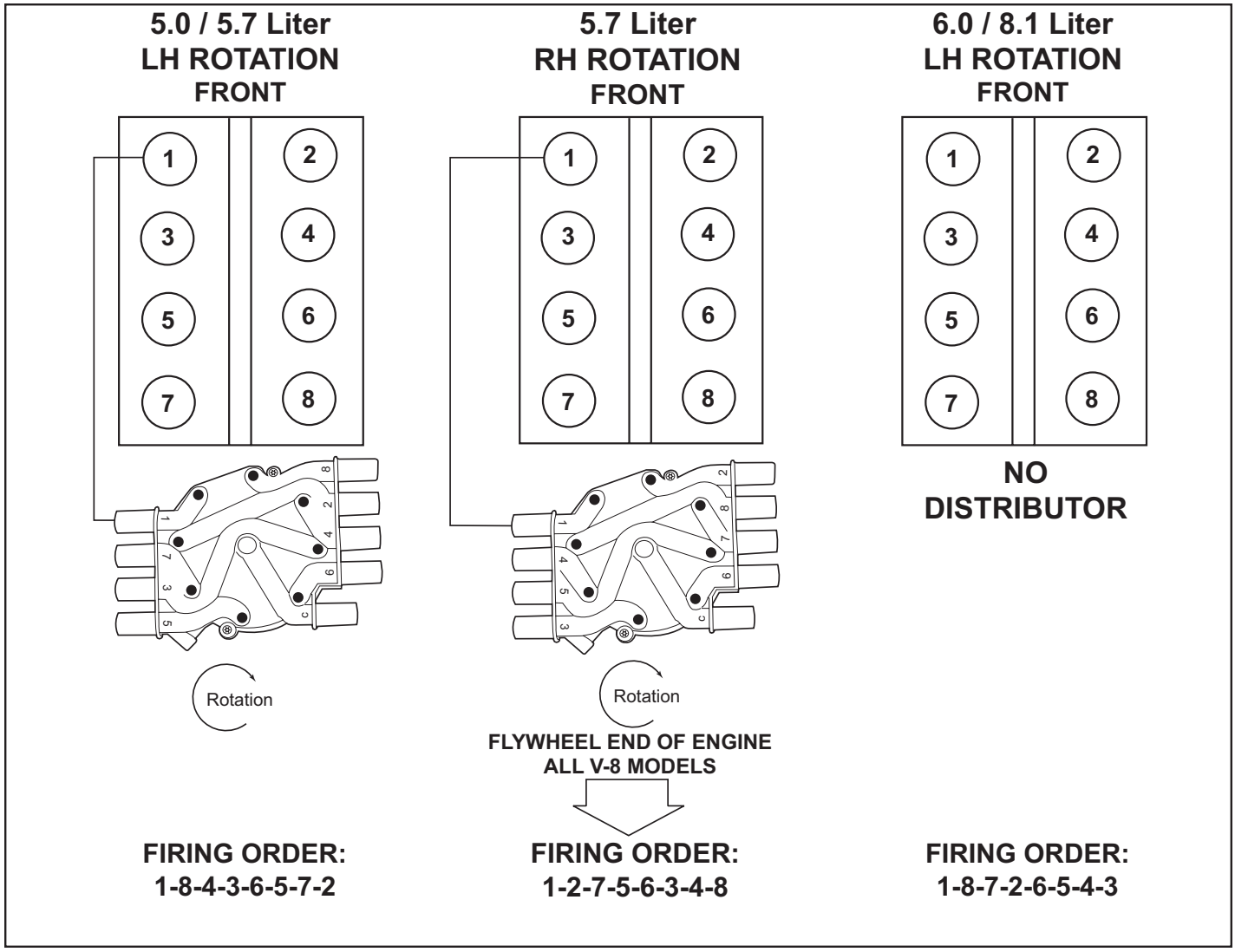


Figure 12-1 V-8 Firing Orders

TUNE-UP SPECIFICATIONS

Model	**MP 5.0L (275 HP) MP 5.7L (330 HP)**	**MP 6.0L (375 HP)**	**MP 8.1L(STD) (385 HP) MP 8.1L (HO) (425 HP)**
Spark Plug Type	R030010	R030011	R030009
Spark Plug Gap	0.060 in. (1.52 mm)	0.060 in. (1.52 mm)	0.060 in. (1.52 mm)
Ignition Timing	Fixed, Not Adjustable	Fixed, Not Adjustable	Fixed, Not Adjustable
Firing Order	1-8-4-3-6-5-7-2 (LH Rotation) 1-2-7-5-6-3-4-8 (RH Rotation)	1-8-7-2-6-5-4-3 (LH Rotation)	1-8-7-2-6-5-4-3 (LH Rotation)
CAM Retard	43-47 degrees	Not Adjustable	Not Adjustable

ENGINE STORAGE

IMPORTANT: This service should be performed by an Authorized Crusader Dealer.

CAUTION

Refer to FLUSHING COOLING SYSTEM before proceeding.

1. Fill the fuel tanks with gasoline (that does not contain alcohol) and add a sufficient amount of gasoline stabilizer, such as STA-BIL™ fuel stabilizer, to prevent the formation of fuel gum and varnish. Follow the instructions on the container.

IMPORTANT: If the boat is to be placed into storage with fuel containing alcohol in the fuel tanks, the engine fuel system must be run dry at idle RPM. Fuel tanks should be drained completely and fuel conditioner, such as STA-BIL™, added to any fuel remaining in the tanks.

WARNING

Operate the bilge blower and be sure no fuel vapors are present when treating the engine. Be sure the engine compartment is well-ventilated to prevent a potential fire hazard.

2. Run the engine and allow it to reach normal operating temperature. Shut down the engine and change the oil and oil filter (See ENGINE MAINTENANCE).

3. Flush the cooling system if operating in salt water or brackish water areas. (See ENGINE MAINTENANCE).

WARNING

Operate the bilge blower and be sure no fuel vapors are present when treating the engine. Be sure the engine compartment is well-ventilated to prevent a potential fire hazard.

4. Restart the engine and allow it to idle for 5 minutes.

5. Turn off the ignition and remove the spark plugs. Use an aerosol-type fogging solution and spray a sufficient amount into each cylinder. (Spray 5 seconds per cylinder, minimum.) Turn the crankshaft several revolutions by hand to spread the oil evenly throughout the cylinders.

NOTE: If you are using a bulk type preservative oil, pour approximately one (1) teaspoon full of oil into each cylinder, through the spark plug hole, then turn the crankshaft several revolutions by hand to spread the oil evenly throughout the cylinders.

6. Install the spark plugs and connect the spark plug wires.

NOTE: It will be necessary to remove the spark plugs and spin the engine to eliminate excess oil prior to restarting after the storage period.

7. Remove and clean the flame arrestor and the vent hoses, and reinstall on the engine. Cover the throttle body assembly ,to prevent the possibility of the water entering the engine through the throttle body assembly, during storage.

8. Close the fuel shut-off valve (if equipped).

WARNING

On fuel injected engines, you MUST bleed off fuel pressure before proceeding. Failure to do so may cause personal injury.

9. Remove, empty and clean the fuel filter shell. Reinstall with a new fuel filter and gasket. Refer to Engine Maintenance for filter replacemnt procedures.

NOTE: DO NOT re-use old fuel filter components. Always replace with new fuel filter and gasket.

DRAINING INSTRUCTIONS

CAUTION

If the boat is to remain in the water during or after draining, close the seacock to prevent a siphoning action that may occur, allowing sea water to flow from drain holes or removed hoses.

IMPORTANT: When removing the drain plugs, insert a wire into the hole to remove any obstruction which would prevent water from draining completely.

FRESH-WATER COOLED MODELS

IMPORTANT: The fresh-water section of the cooling system must be kept filled year around with recommended coolant. Make certain that the cooling system is protected with an ethylene glycol antifreeze mixture properly mixed to protect the engine to the lowest temperature that it will be exposed to.

See the ENGINE MAINTENANCE section for testing alkalinity, draining and refilling procedures of the Fresh Water Cooling System, as required.

IMPORTANT: Drain the sea-water section of the cooling system only.

1. Remove all the drain plugs from the following locations:
   - Heat Exchanger - one on outboard side
   - Exhaust Elbows (**5.0/5.7/8.1L ONLY**) - two on each side
   - Transmission and Engine Cooler - one drain plug
   - Fuel Cooler Canister (Returnless Fuel System Only) - one drain plug
2. Remove the hose from the inlet side of the sea-water pump.
3. Remove the hose from the outlet side of the sea-water pump.

NOTICE: It may be necessary to bend or lift the hoses to allow water to drain completely.

4. Remove the raw water pump impeller. (See ENGINE MAINTENANCE) If inspection proves the impeller to be in good condition, store it in an accessible spot for re-installation at the end of the storage period. A damaged or badly worn impeller should be discarded and a new one installed at the end of the storage period.

NOTE: Removal of the impeller during storage will prevent the impeller vanes from drying and taking a permanent “set”.

5. After the water has completely drained, coat the threads of drain plugs with PerfectSeal (or equivalent), and reinstall in the proper locations. Reinstall the hoses and tighten all the clamps securely.
6. Loosen the engine alternator and raw water pump drive belt(s).

After draining is completed, perform the additional required maintenance as outlined in the MAINTENANCE SCHEDULE under ONCE EACH YEAR.

BATTERY STORAGE

Follow the battery manufacturer’s instructions for storage. If not available, use the following instructions:

- Remove the battery from the boat and clean, removing dirt and grease from the top of the battery.
- Fill the battery with distilled water to the manufacturer’s specifications.
- Store the battery in a cool, dry place. Do not store on a concrete surface.
- Periodically (every 30 to 45 days), check the water level and recharge the battery to the manufacturer’s specifications. Do not fast charge.

CAUTION

A discharged battery can be damaged by freezing.

OUT-OF-SEASON ENGINE WARM-UP

If it is necessary to start your engine(s) during cold weather storage, refer to the following procedure.

1. Refer to “Recommissioning After Storage” to make certain all drain plugs, hoses, batteries and connections are secure.
2. Start the engine(s) and idle until normal engine oil pressure is reached.
3. Raise the engine RPM and hold at 1500 RPM until NORMAL operating temperature is reached.
4. Raise the engine RPM again and hold at 2500 RPM. Allow the engine to run for approximately 5 minutes in order to heat up the exhaust system.
5. Return the engine to idle speed and shut the engine “OFF.”
6. Refer to “Engine Storage” and “Draining Instruction” to make certain the engine is fully protected from freezing during the remaining storage period.

Following this procedure will reduce the possibility of condensation build up in the engine exhaust system, due to cold weather start-ups.

RECOMMISSIONING AFTER STORAGE

IMPORTANT: This service should be performed by an Authorized Crusader Marine Engines Dealer.

When recommissioning the engine after storage, the following items should be checked:

1. Assemble the raw water pump and reinstall on the engine.
2. Check all the cooling system hoses. Be sure they are properly connected and all the hose clamps are tight.

CAUTION

When installing the battery, make certain that you connect the POSITIVE (+) BATTERY CABLE to the POSITIVE (+) BATTERY TERMINAL first, and the NEGATIVE (-) BATTERY CABLE to the NEGATIVE (-) BATTERY TERMINAL last. If the battery cables are reversed, the electrical system will be damaged.

WARNING

Do not use jumper cables and/or a booster battery to start the engine. Do not recharge a weak battery in the boat. Remove the battery and recharge in a ventilated area away from fuel vapors, sparks or open flame.

3. Install the fully charged battery. Be sure that all the connections are clean and free from corrosion. Coat the battery terminal connections with an anti-corrosion battery terminal spray.
4. Readjust alternator and water pump drive belt tension.
5. Check engine alignment.
6. Check engine and transmission oil levels.
7. Check engine mount fasteners.

RECOMMISSIONING AFTER STORAGE

CAUTION

Failure to remove the excess storage oil from the engine's cylinders can cause hydrostatic locking to occur, and severe damage to the engine.

8. Before starting the engine, be sure there is not an excess amount of storage oil left in the cylinders. Remove the spark plugs. Disable the fuel pumps and ignition high voltage spark by removing the MEFI System Relay. Using rags draped over the exhaust manifolds or some other suitable material or method, create a deflector or catcher for the oil that will be sprayed from the spark plug holes. Turn the ignition switch to the start position and rotate the engine three (3) or four (4) times.

9. Reinstall the MEFI System Relay.

10. Install the spark plugs and connect the spark plug wires.

11. Open the fuel shut-off valve (if equipped).

12. Refer to the OPERATING INSTRUCTIONS section and perform all the safety checks before starting the engine.

13. Refer to the Engine Maintenance section and perform the Priming the Fuel System instructions.

CAUTION

If the engine(s) is (are) to be started prior to launching, use the procedure FLUSHING COOLING SYSTEM before proceeding to start the engine(s).

14. Open the seacock before starting the engine.

15. Start the engine and closely observe the instrument panel. Allow the engine to reach normal operating temperature. Inspect the engine carefully for fuel, exhaust, oil and water leaks.

16. Check the steering, shift and throttle controls for proper operation.

TROUBLESHOOTING - 14

Engine performance complaints usually fall under one of the basic headings listed in the Troubleshooting Guide. When a problem cannot be easily diagnosed, consult a Crusader Marine Engines Servicing Dealer for assistance.

Malfunction	Possible Cause	Corrective Action
"Check Engine" light on with the engine running	Problem with the engine management system.	Contact Crusader Marine Engines Dealer.
Engine will not crank with the starter motor, or cranks slowly. **NOTICE:** Battery voltage must be AT or ABOVE 10 volts while the engine is cranking or the engine management system will not function.	Battery switch turned OFF (if equipped)	Turn the battery switch ON.
	Remote control not in Neutral position.	Position the remote control exactly in Neutral.
	Blown the ignition fuse or open circuit breakers.	Replace the fuse - reset circuit breakers.
	Loose and/or dirty wiring connections.	Check the battery cables and starter circuit wiring. Clean and tighten all connections. Repair or replace the damaged wiring.
	Dead Battery	Recharge, test and replace as necessary.
Engine Cranks - will not start or is hard starting. **NOTICE:** Battery voltage must be AT or ABOVE 10 volts while the engine is cranking or the engine management system will not function.	Improper starting procedure.	Refer to "STARTING ENGINE" in the OPERATING INSTRUCTIONS section.
	No fuel - empty fuel tank	Check the fuel tank level - fill tank(s). Open shut-off valve(s).
	No fuel to the throttle body (TBI) or the injectors (MPI)	Plugged fuel filters. Plugged or kinked fuel lines or plugged fuel-tank vent. Faulty fuel pump - check electrical connections. Faulty anti-siphon valve.
	Engine flooded	Open the throttle 100% and crank the engine. When the engine starts, immediately return the throttle to 1000 RPM.
	Ignition system malfunction	Contact Crusader Marine Engines Dealer.
	Contaminated fuel	Check fuel for water or other contamination. If contaminated, drain and clean the fuel system.

Malfunction	Possible Cause	Corrective Action
Engine Overheats	Loose or worn drive belt(s)	Adjust or replace the belts as necessary.
	Collapsed, kinked or leaking hoses.	Replace the hoses.
	Transmission/engine oil cooler plugged	Remove the water hoses and flush in opposite direction of the normal flow.
	Faulty thermostat	Replace the thermostat.
	Sea-water intake valve partially/fully closed.	Open the valve completely.
	Restricted sea-water pickup	Remove restriction.
	Faulty temperature sending unit or gauge	Test and replace as necessary.
	Sea-water pump impeller worn or damaged	Replace the impeller.
The following applies to engines equipped with Fresh-Water Cooling (FWC) systems.	Coolant level low in the fresh-water section of the cooling system	Check the cooling system for leaks. Refill the system. See Warning before removing the fill cap.
	Heat exchanger passages plugged with scales and debris	Clean and flush the exchanger.
	Improper coolant mixture	Install the proper coolant mixture (50% antifreeze - 50% water).
Insufficient engine temperature	Faulty thermostat	Replace the thermostat.
	Faulty temperature sender	Replace the temperature sender.
Engine oil pressure low	Faulty oil pressure sending unit or gauge	Test and replace as necessary.
	Oil level low	Add specified oil. Check the engine for leaks.
	Crankcase overfilled causing oil aeration	Remove the required amount of oil. Determine the cause of overfilled condition (improper filling, etc.).
	Diluted or improper grade/ viscosity of oil	Change the oil and filter. Determine the cause of dilution. (insufficient engine temperature, excessive idling, etc.)

Malfunction	Possible Cause	Corrective Action
Transmission slipping - erratic operation	Low oil level	Add specified oil. Check the transmission for leaks.
	Transmission overfilled causing oil aeration	Drain required amount of oil.
	Transmission shift lever not fully engaged	Adjust the shift linkage and remote control. Check the shift cables for freedom of movement and binding.
	Contaminated fluid	Determine and correct the contamination source and change the fluid.
Engine misses, runs rough and/or backfires	Ignition system malfunction	Contact Crusader Marine Engines Dealer.
	Plugged fuel filters	Replace the fuel filters.
	Faulty fuel pump.	Have fuel pump replaced by a Crusader Marine Engines Dealer
	Plugged or kinked fuel lines or fuel tank vent	Repair or replace the fuel lines. Remove obstruction.
	Anti-siphon valve faulty	Clean or replace as necessary.
	Flame arrestor dirty	Clean the flame arrestor.
Poor engine or boat performance	Ignition malfunction	Contact Crusader Marine Engines Dealer.
	Throttle not fully open	Check the remote control and throttle body linkage for freedom of movement and proper adjustment.
	Damaged or improper propeller	Repair or replace as necessary.
	Excessive water in the bilge	Pump the water out and investigate source of entry.
	Excessive growth on the boat bottom	Clean the bottom and paint with an anti-fouling paint.
	Boat overloaded	Reduce and/or redistribute the load.
	Dirty flame arrestor	Clean the flame arrestor.
	Engine overheating	Repair the cooling system (See “Engine Overheats”).

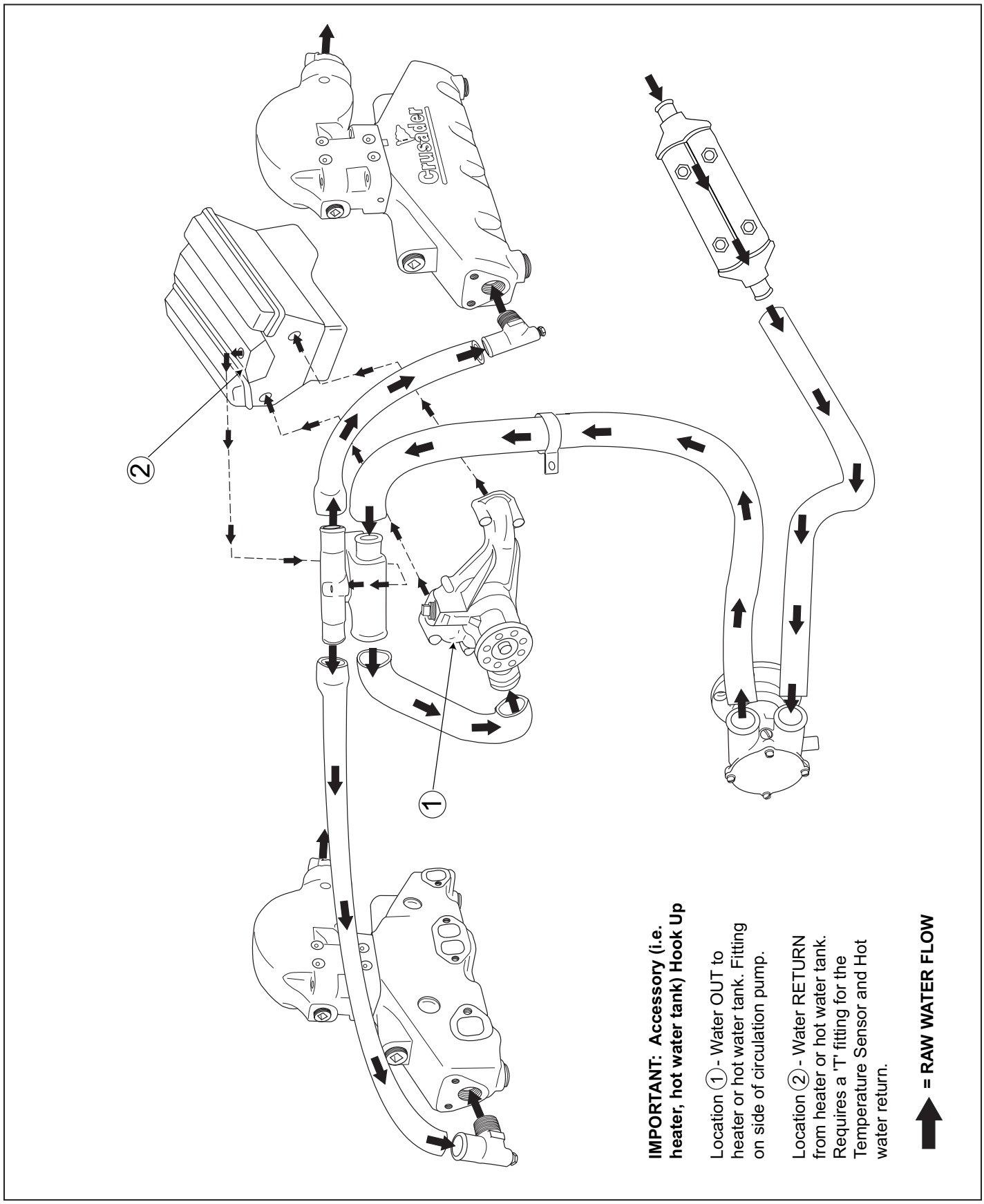

Crusader
2
1
IMPORTANT: Accessory (i.e. heater, hot water tank) Hook Up
Location ① - Water OUT to heater or hot water tank. Fitting on side of circulation pump.
Location ② - Water RETURN from heater or hot water tank. Requires a 'T' fitting for the Temperature Sensor and Hot water return.
= RAW WATER FLOW

Figure 15-1 Raw-Water Cooling System (5.0/5.7L)

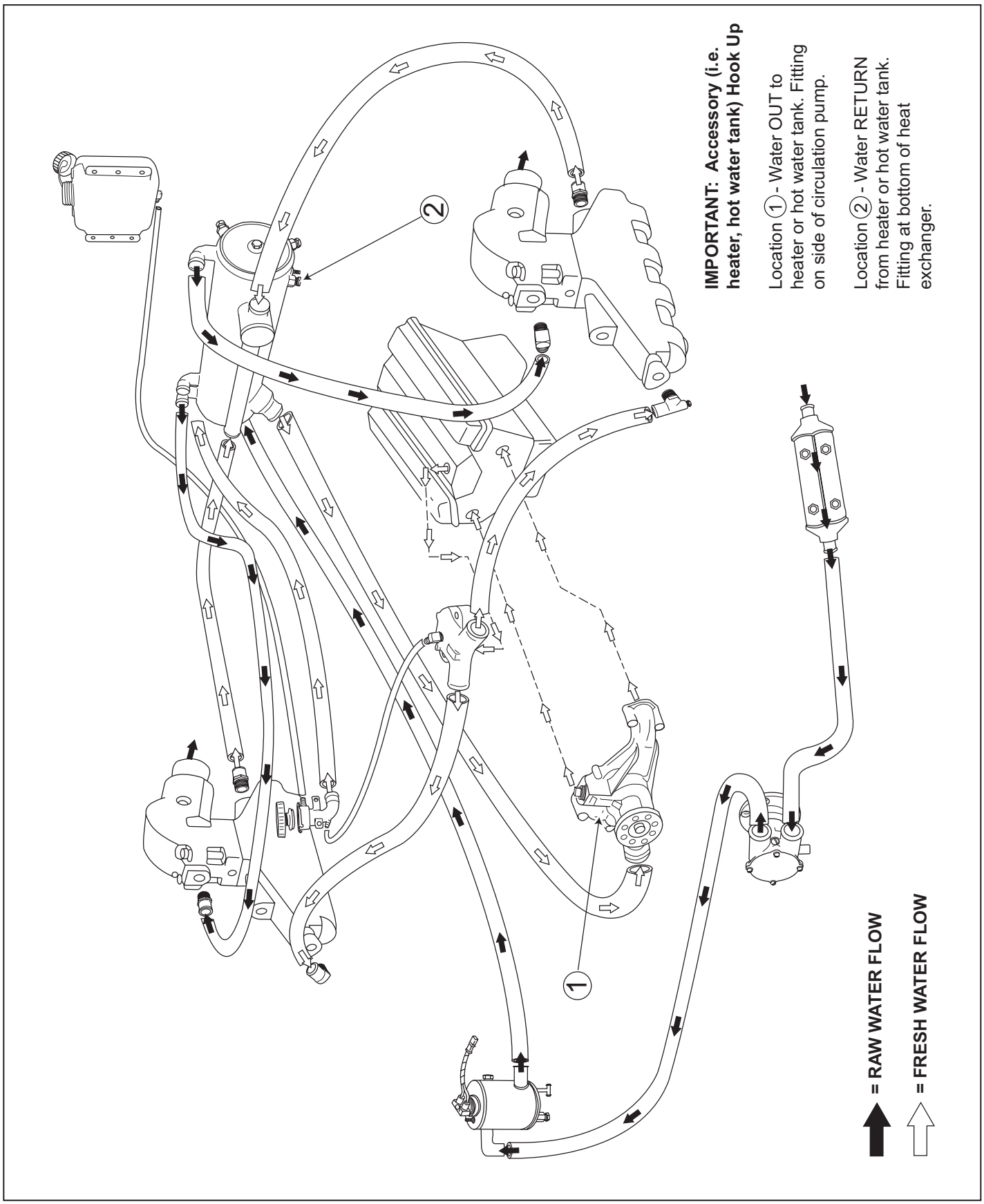
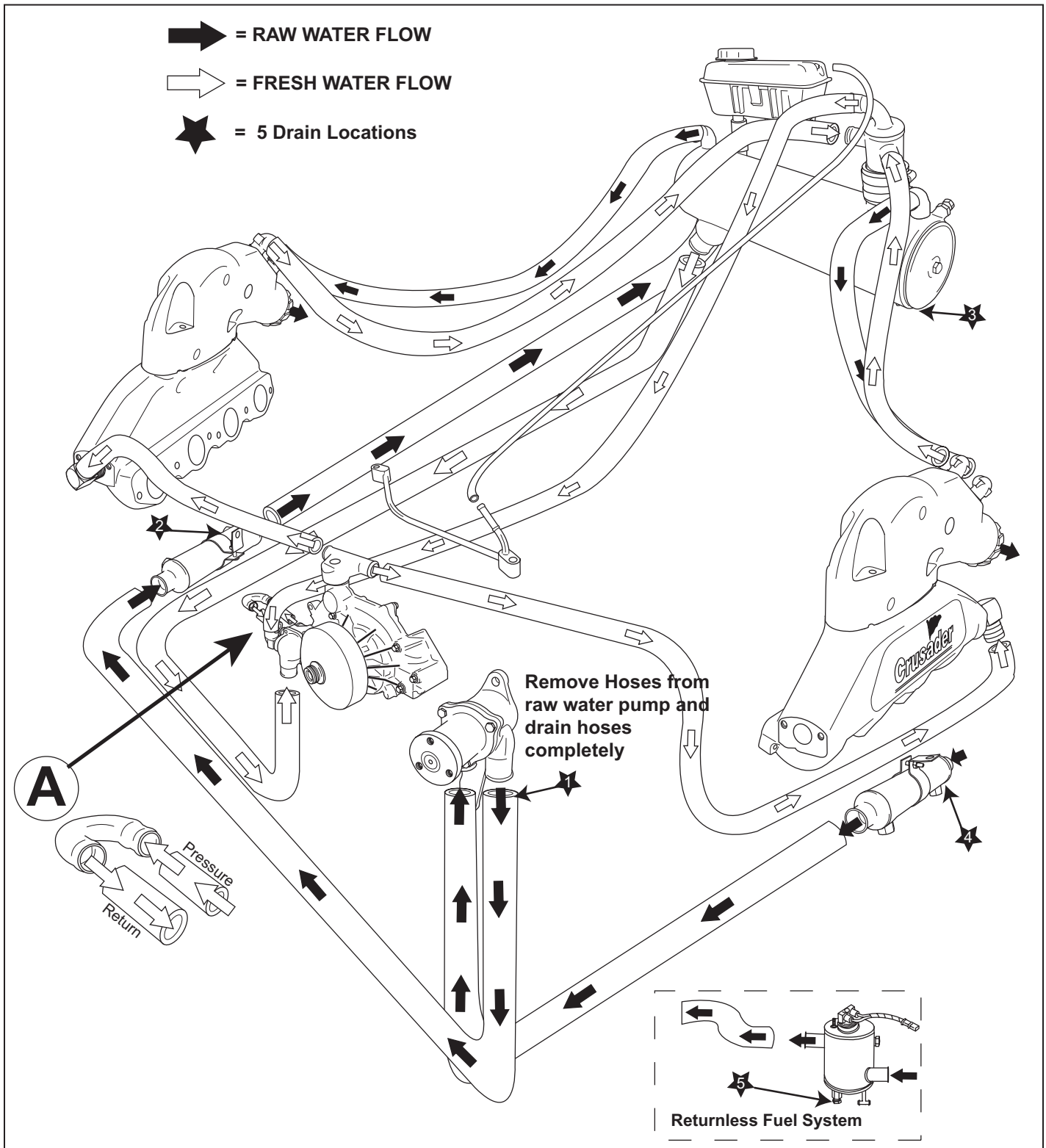

IMPORTANT: Accessory (i.e. heater, hot water tank) Hook Up
Location ① - Water OUT to heater or hot water tank. Fitting on side of circulation pump.
Location ② - Water RETURN from heater or hot water tank. Fitting at bottom of heat exchanger.
= RAW WATER FLOW
= FRESH WATER FLOW
1
2

Figure 15-2 Fresh-Water Cooling System (5.0/5.7L)



IMPORTANT: Accessory (i.e. heater, hot water tank) Hook Up

NOTE: Location (A) is the location in order to hook up a hot water accessory.

Figure 15-2 Fresh-Water Cooling System (6.0L)

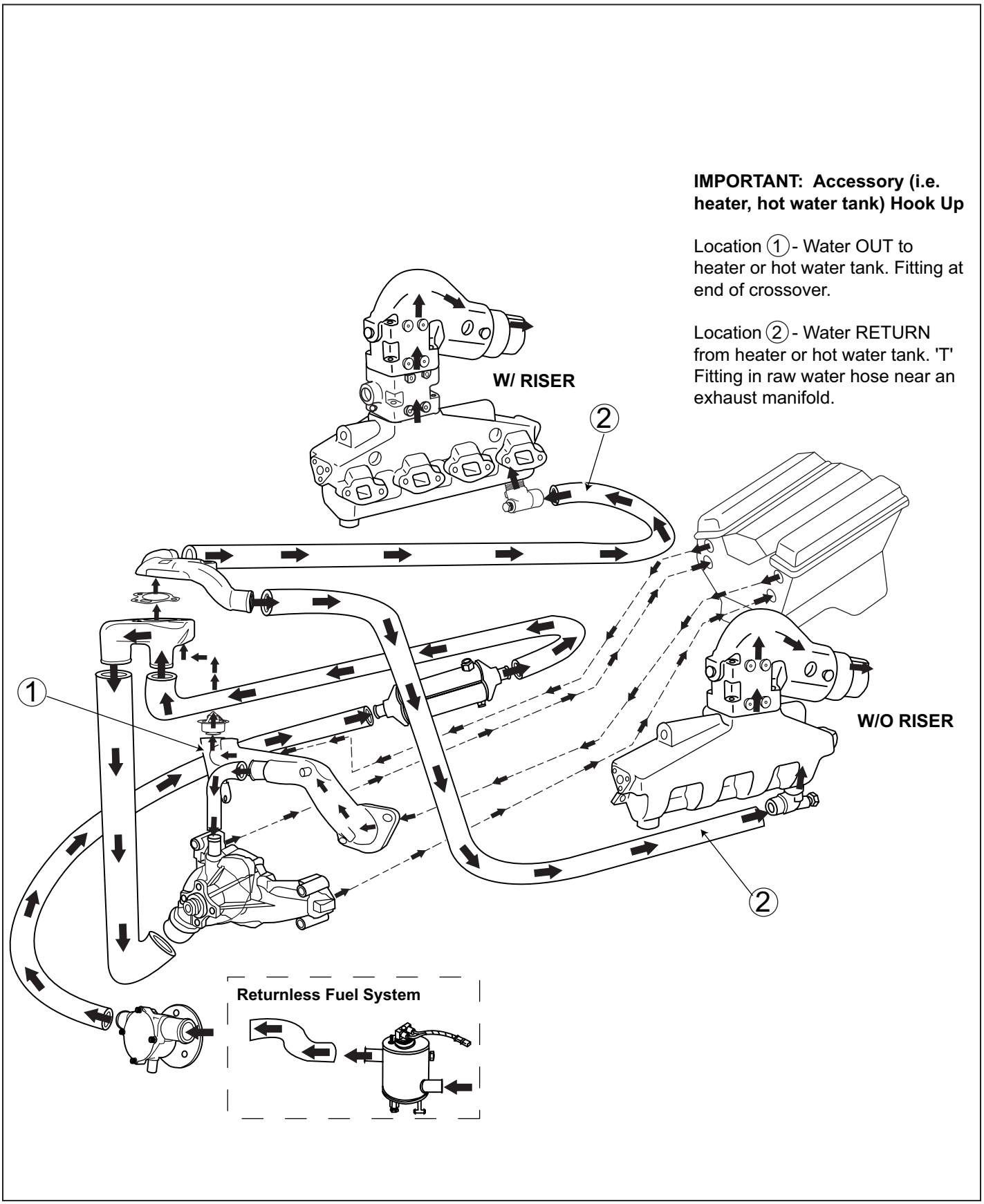

IMPORTANT: Accessory (i.e. heater, hot water tank) Hook Up
Location 1 - Water OUT to heater or hot water tank. Fitting at end of crossover.
Location 2 - Water RETURN from heater or hot water tank. 'T' Fitting in raw water hose near an exhaust manifold.
W/ RISER
W/O RISER
1
2
2
Returnless Fuel System

Figure 15-3 Raw-Water Cooling System (8.1L)

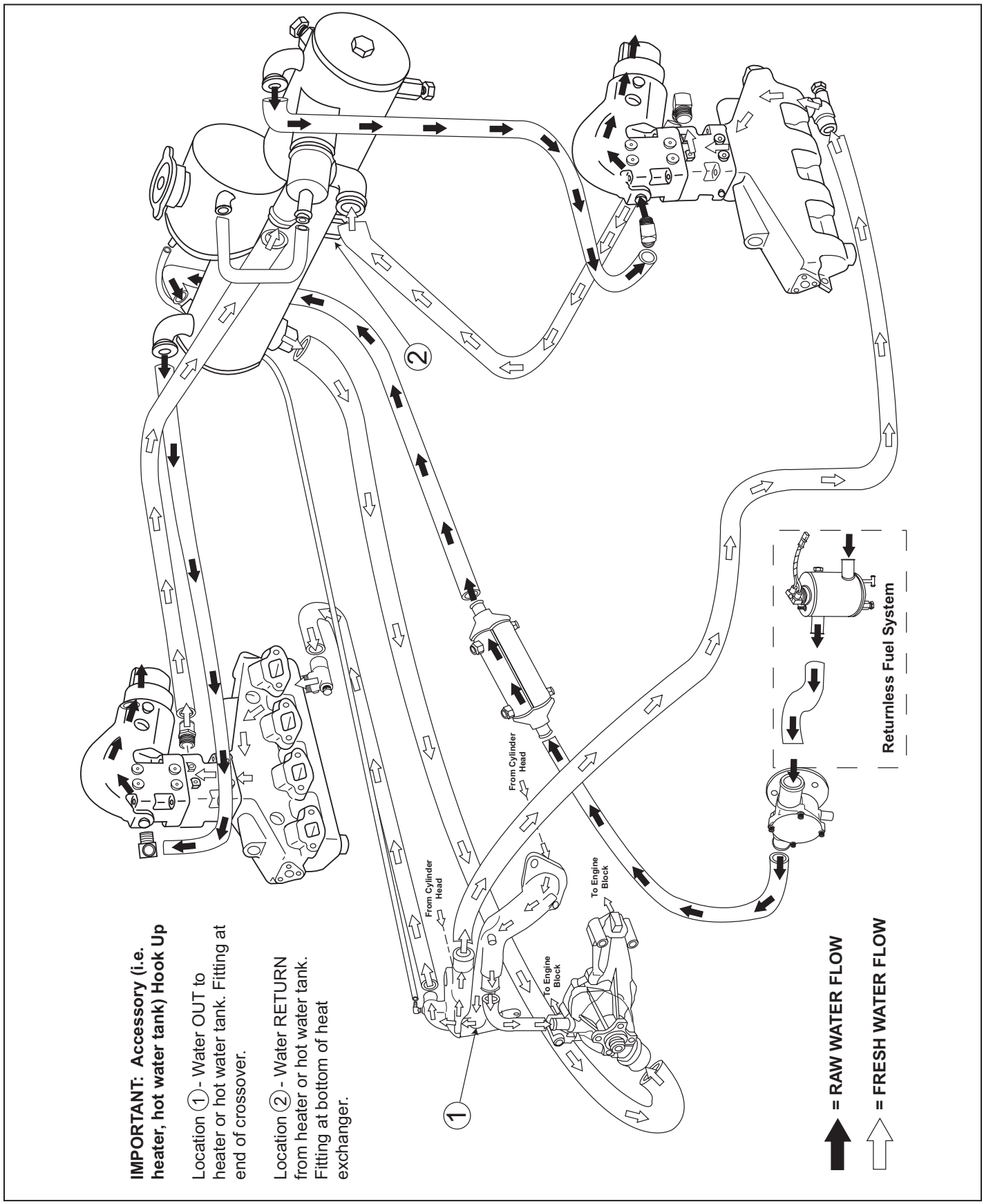

IMPORTANT: Accessory (i.e. heater, hot water tank) Hook Up
Location ① - Water OUT to heater or hot water tank. Fitting at end of crossover.
Location ② - Water RETURN from heater or hot water tank. Fitting at bottom of heat exchanger.
From Cylinder Head
From Cylinder Head
To Engine Block
To Engine Block
Returnless Fuel System
= RAW WATER FLOW
= FRESH WATER FLOW
1
2

Figure 15-4 Fresh-Water Cooling System (8.1L)

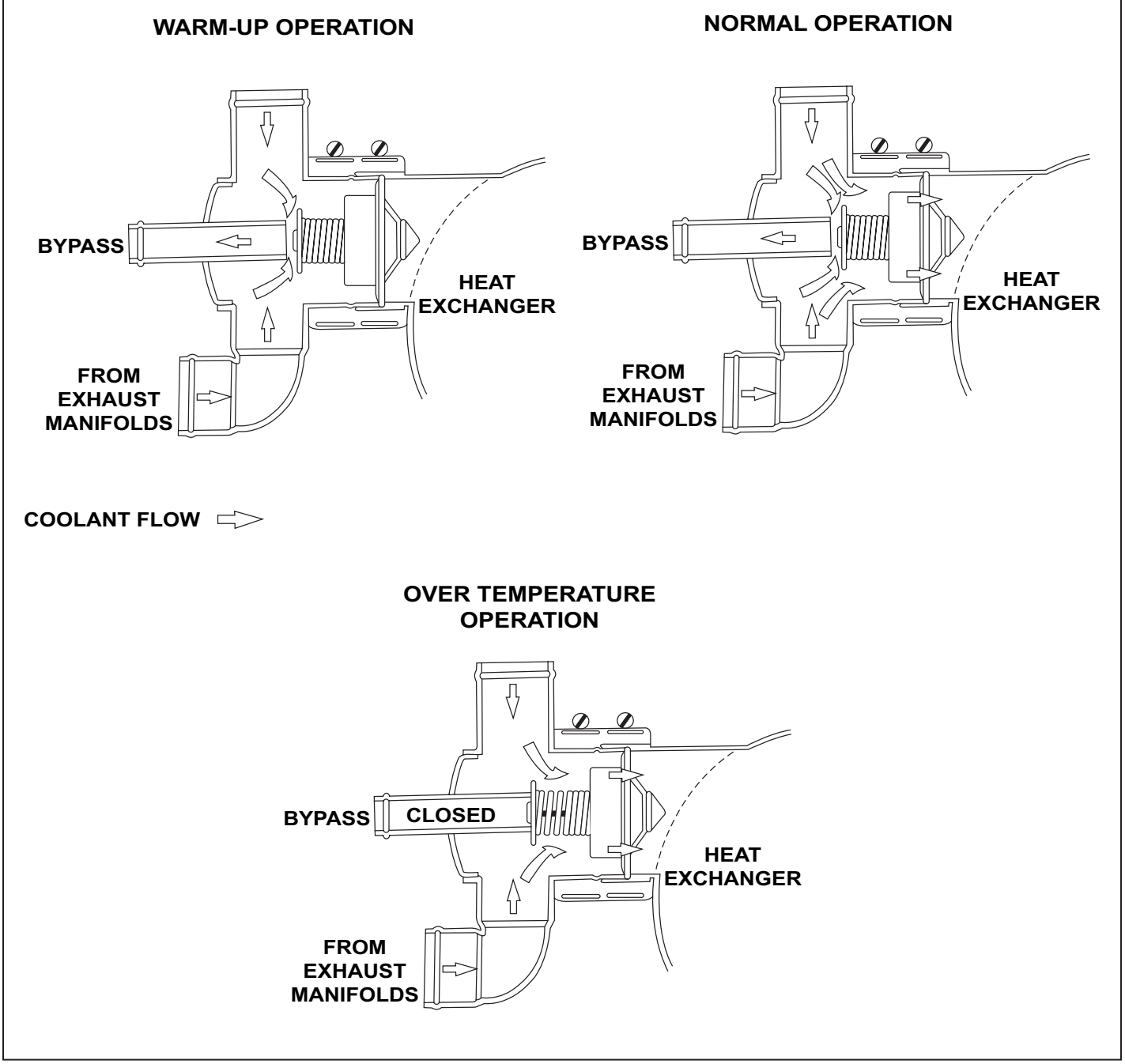


Figure 15-5 Thermostat Housing Waterflow Diagrams and Fill-Riser Waterflow - 8.1L Fresh-Water Cooled

WIRE HARNESS COLOR CHART

CIRCUIT NUMBER	CIRCUIT NAME	ENGINE HARNESS WIRE COLOR
1.	GROUND	BLACK
2.	TACHOMETER	GRAY
3.	WATER TEMPERATURE	TAN
4.	ENGINE ALARM	TAN/BLACK
5.	IGNITION	PURPLE/WHITE
6.	BATTERY	RED/WHITE
7.	STARTER	YELLOW/RED
8.	OIL PRESSURE	LT. BLUE
9.	CHECK ENGINE LIGHT	BROWN/WHITE
10.	DATA LINE	ORANGE/BLACK

NOTE: ENGINE HARNESS WIRED FOR PANELS USING VOLTMETERS ONLY.

NOTE (A): POWER FOR A FUSED ACCESSORY PANEL MAY BE TAKEN FROM THIS LOCATION. LOAD CANNOT EXCEED 30 AMPS.

NOTE: The light green wire, pigtail, located near the engine harness connector is for connection of a buzzer or light to indicate low oil pressure.

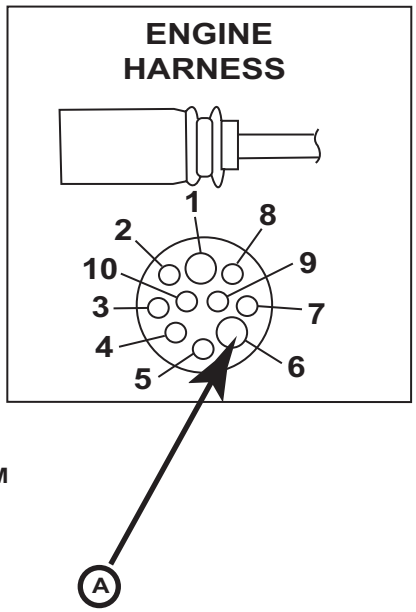


Figure 16-1 Typical Instrumentation Wiring

LITERATURE - 17

To obtain service and/or parts literature for your Crusader Marine Engine, contact the following:

Crusader Marine Engines
Pleasurecraft Engine Group
Publications Department
1737 Highway 76 East
Little Mountain, SC 29075

IMPORTANT: When contacting the factory for service information, be sure to include your engine model and serial number to insure the service information you receive is correct.

SUMMARY OF WARRANTY TERM LIMITS

This list does not, in any way, modify the official Limited Warranty Statement of Crusader Engines. This list has been compiled only as a general outline of year and hour limits imposed on different models of Crusader engines. Please review the official Limited Warranty Statements for specific terms and limitations as they apply to the particular engine / component involved.

ENGINE MODEL YEAR:	WARRANTY COVERAGE TERM:
1994 - 1998	2 years, unlimited hours, GM engine. 2 years, unlimiited hours, Transmission.
1999*	1 year, unlimited hours, GM engine. 1 year unlimited hours, Transmission.
2000*	1 year, unlimited hours, GM engine. 1 year, unlimited hours, Transmission.
2001**	1 year, unlimited hours, GM engine. 1 year, unlimited hours, Transmission.
2002**	1 year, unlimited hours, GM engine. 1 year, unlimited hours, Transmission.
2003**	1 year, unlimited hours, GM engine. 1 year, unlimited hours, Transmission.
2004**	1 year, unlimited hours, GM engine. 1 year, unlimited hours, Transmission.
Base Engine	1 year, 200 hours with exclusions.

Note:

1994 – 1998. 1 year unlimited hours for Champion Series.

* Platinum Series has additional 4 years extended warranty administered by First Protection Corporation.

** Captains Choice Series has additional 2 years extended warranty administered by First Protection Corporation.

CRUSADER OWNERSHIP CHANGE NOTICE

If you are the new owner of a Crusader Marine Engine on which the warranty has expired and would like to inform Crusader of your ownership for notification purposes in case of Service Updates, Recalls, etc., complete the section below and return by mail to Crusader Marine Engines, PO Drawer 369, Little Mountain, SC 29075.

	PORT	STARBOARD
ENGINE MODEL:		
ENGINE SERIAL NUMBER:		
TRANS. MODEL:		
TRANS. SERIAL NUMBER:		
HULL SERIAL #:		

(New Owner) NAME: _____

ADDRESS: _____

CITY,STATE,ZIP: _____

DATE OF PURCHASE: _____

(Previous Owner)NAME: _____

ADDRESS: _____

CITY,STATE,ZIP: _____

CRUSADER WARRANTY TRANSFER APPLICATION 2004

(PORT OR SINGLE ENGINE)

The remainder of the original Crusader limited warranty is transferable **within thirty (30) days of date of sale** by the original owner/user to a subsequent purchaser for the remainder of the unused portion of the original warranty term, **provided the engine(s) operating hours do not exceed 300.** The original date of sale or original in-service date (whichever comes first) begins the warranty coverage period.

Direct Sale by Owner/Dealer or First Operator:

- The second purchaser can be registered as the owner and retain the unused portion of the warranty term by sending the following:
  - Original owner's Warranty Registration Card
  - Copy of Bill of Sale/Sales Contract/Operator Contract
  - Completed Warranty Transfer Application
  - Warranty transfer fee

Transfer Fee:

- **The fee for transfer is $50.00 per engine.** The applicable transfer fee must be submitted via certified check **within 30 days of date of sale** along with the transfer application information to:

  Crusader Marine Engines
  Marine Warranty Transfer
  40580 Van Dyke Blvd.
  Sterling Heights, MI. 48313 USA

- A new "Owner Warranty Registration Card" will be issued with the new owner's name and address. Registration records will be changed in the factory registration file.

OUTSIDE THE U.S. AND CANADA, CONTACT YOUR LOCAL CRUSADER DEALER OR WARRANTY SERVICES AT (586)977-0100 FOR MORE INFORMATION ON HOW TO APPLY TO THIS PROGRAM.

IMPORTANT! PURCHASER NOTICE: The checks listed below are designed to insure safety and satisfaction. Premier Crusader Dealer Technicians have received step-by-step instruction in the performance of the Pre-Delivery Inspection. Therefore, we require the following inspection be performed at your expense by a qualified technician prior to delivery. By signature the technician certifies that he/she has checked the installation and operation of the engine and finds it to be performing properly. All terms in the Limited Warranty located in the Engine Owners Manual still apply.

ENGINE MODEL:_____ **ENGINE SERIAL:**_____

TRANS. SERIAL:_____ **ENGINE HOURS:**_____

HULL SERIAL #:_____

Pre-Delivery Checklist - PORT or Single

- ☐ Check for Bulletins
- ☐ Engine Oil: Check
- ☐ Drive Lube: Check
- ☐ Battery Rating, Charge, and Level: Check
- ☐ Control Adjustments: Confirm Proper Operation
- ☐ Gauges: Check for Proper Operation
- ☐ Belt and Pulley: Inspect for Damage
- ☐ All Drain Plugs: Confirm Proper Installation
- ☐ All Fuel Lines: Confirm No Leaks
- ☐ All Oil Lines: Confirm No Leaks
- ☐ All Water Lines: Confirm No Leaks
- ☐ Electrical Wiring: Check for Proper Installation
- ☐ Record Propeller Size, Rotation and WOT
  WOT RPM_____Diameter_____ Pitch_____Rotation_____
- ☐ Record Fuel Pressure, WOT _____
- ☐ Trouble Codes Checked
  Trouble Codes Cleared
- ☐ Dealer Reviewed Warranty with Owner

Type Information
To Prevent
Processing Delay

DATE OF SALE (2ND Owner) _____/_____/_____ **DATE OF SALE (1st Owner/1st Operator)** _____/_____/_____

(New Owner)
NAME:_____

ADDRESS:_____

CITY,STATE, ZIP_____

(Previous Owner)
NAME:_____

ADDRESS:_____

CITY,STATE, ZIP_____

I hereby certify the Pre-Delivery Checklist on engine #_____ and have corrected any abnormality revealed by this inspection.

_____ **(Technician Signature, Dealer & Date)**

_____ **(Seller's Signature & Date)**

_____ **(Purchaser's Signature & Date)**

Crusader ENGINES

CRUSADER WARRANTY TRANSFER APPLICATION 2004
(STARBOARD ENGINE)

The remainder of the original Crusader limited warranty is transferable **within thirty (30) days of date of sale** by the original owner/user to a subsequent purchaser for the remainder of the unused portion of the original warranty term, **provided the engine(s) operating hours do not exceed 300.** The original date of sale or original in-service date (whichever comes first) begins the warranty coverage period.

Direct Sale by Owner/Dealer or First Operator:

- The second purchaser can be registered as the owner and retain the unused portion of the warranty term by sending the following:
  - Original owner's Warranty Registration Card
  - Copy of Bill of Sale/Sales Contract/Operator Contract
  - Completed Warranty Transfer Application
  - Warranty transfer fee

Transfer Fee:

- **The fee for transfer is $50.00 per engine.** The applicable transfer fee must be submitted via certified check **within 30 days of date of sale** along with the transfer application information to:

  Crusader Marine Engines
  Marine Warranty Transfer
  40580 Van Dyke Blvd.
  Sterling Heights, MI. 48313 USA

- A new "Owner Warranty Registration Card" will be issued with the new owner's name and address. Registration records will be changed in the factory registration file.

OUTSIDE THE U.S. AND CANADA, CONTACT YOUR LOCAL CRUSADER DEALER OR WARRANTY SERVICES AT (586)977-0100 FOR MORE INFORMATION ON HOW TO APPLY TO THIS PROGRAM.

IMPORTANT! PURCHASER NOTICE: The checks listed below are designed to insure safety and satisfaction. Premier Crusader Dealer Technicians have received step-by-step instruction in the performance of the Pre-Delivery Inspection. Therefore, we require the following inspection be performed at your expense by a qualified technician prior to delivery. By signature the technician certifies that he/she has checked the installation and operation of the engine and finds it to be performing properly. All terms in the Limited Warranty located in the Engine Owners Manual still apply.

ENGINE MODEL:_____ **ENGINE SERIAL:**_____

TRANS. SERIAL:_____ **ENGINE HOURS:**_____

HULL SERIAL #:_____

Pre-Delivery Checklist - STARBOARD

☐ Check for Bulletins	☐ Belt and Pulley: Inspect for Damage
☐ Engine Oil: Check	☐ All Drain Plugs: Confirm Proper Installation
☐ Drive Lube: Check	☐ All Fuel Lines: Confirm No Leaks
☐ Battery Rating, Charge, and Level: Check	☐ All Oil Lines: Confirm No Leaks
☐ Control Adjustments: Confirm Proper Operation	☐ All Water Lines: Confirm No Leaks
☐ Gauges: Check for Proper Operation	☐ Electrical Wiring: Check for Proper Installation
☐ Record Propeller Size, Rotation and WOT WOT RPM_____Diameter_____ Pitch_____Rotation_____	
☐ Record Fuel Pressure, WOT _____	☐ Trouble Codes Checked Trouble Codes Cleared
☐ Dealer Reviewed Warranty with Owner	

Type Information To Prevent Processing Delay

DATE OF SALE (2ND Owner) _____/_____/_____ **DATE OF SALE (1st Owner/1st Operator)** _____/_____/_____

(New Owner)
NAME:_____

ADDRESS:_____

CITY,STATE, ZIP_____

(Previous Owner)
NAME:_____

ADDRESS:_____

CITY,STATE, ZIP_____

I hereby certify the Pre-Delivery Checklist on engine #_____ and have corrected any abnormality revealed by this inspection.

_____ **(Technician Signature, Dealer & Date)**

_____ **(Seller's Signature & Date)**

_____ **(Purchaser's Signature & Date)**

Crusader ENGINES